ENVIRONMENTAL STATEMENT – VOLUME 1 – CHAPTER 11 GROUND CONDITIONS

Drax Bioenergy with Carbon Capture and Storage

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations, 2009 – Regulation 5(2)(a)

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11. GROUND CONDITIONS

11.1. INTRODUCTION

11.1.1. This chapter reports the outcome of the assessment of likely significant environmental effects arising from the Proposed Scheme on Ground Conditions.

11.1.2. Impacts during the construction phase, operational phase and decommissioning of the Proposed Scheme are assessed. A full description of the Proposed Scheme is described in **Chapter 2 (Site and Project Description)** of this ES (document reference 6.1.2).

11.1.3. This chapter (and its associated figures (**Volume 2**) and appendices (**Volume 3**)) is intended to be read as part of the wider ES with particular reference to **Chapter 8 (Ecology)** (document reference 6.1.8), **Chapter 12 (Water Environment)** (document reference 6.1.12), **Chapter 13 (Materials and Waste)** (document reference 6.1.13), **Chapter 16 (Population, Health and Socio-economics)** (document reference 6.1.16) the **Phase 1 Preliminary Risk Assessment** (**Appendix 11.1 of Volume 3** (document reference 6.3.11.1)) and the **Soil Resource and Agricultural Land Classification Survey** (**Appendix 11.2 of Volume 3** (document reference 6.3.11.2))**.**

11.1.4. This chapter:

- **a.** Summarises the legislative and policy framework;
- **b.** Describes consultation undertaken to date;
- **c.** Describes the methodology followed for the assessment;
- **d.** Identifies the potential impacts as a result of the Proposed Scheme;
- **e.** Details the design, mitigation and enhancement measures that have been identified;
- **f.** Reports the assessment of the significant effects of the Proposed Scheme; and
- **g.** Details the monitoring that should be carried out for the Proposed Scheme.

11.1.5. The Proposed Scheme has the potential to affect ground conditions as a result of:

- **a.** During construction:
  - i. During the construction phase, the following activities may impact ground conditions;
    - ~ Earthworks;
    - ~ Enabling works including the preparation of the laydown areas, car parks, haul roads and site establishment;
    - ~ Site preparation, levelling and piling;
    - ~ Underground cooling water flow and return lines (includes deep sheet piled excavations 6 to 7 m deep);

- ~ Installation of the Carbon Capture Plant and Common Plant, including chemical storage and wastewater treatment plant;
- ~ A pipeline carrying Carbon Dioxide (CO2) from Carbon Capture Plant to Carbon Dioxide Delivery Terminal Compound will partially be constructed below ground. The CO2 will be in a liquid state in a pressurised pipeline (understood to be 135bar); and
- ~ Establishment of the proposed seasonal / intermittently wet pond area to the north of the East Construction Laydown Area (relevant for agricultural land only) in the Habitat Provision Area.

ii. During decommissioning, the following activities may impact ground conditions

- ~ It is expected that all above ground plant structures would be removed.

b. During operation:

i. No operational activities as part of the Proposed Scheme are considered to potentially impact on ground conditions. Major maintenance of the plant would be aligned with the regulatory inspection requirements and operational requirements would include activities which are already established on the Site such as chemical deliveries and waste effluent removals.

OPTIONALITY

11.1.6. For the purposes of this assessment the options, as described in **Chapter 2 (Site and Project Description)**, **para 2.2.29** and **para 2.3.4** (construction programming) do not affect the assessment of ground conditions. The effects on ground conditions would be the same for each option as the same activities would take place but using slightly different sequencing.

11.1.7. Regarding the options for the location of Carbon Dioxide Delivery Terminal Compound as described in **Chapter 2 (Site and Project Description)**, **para 2.2.44**, for the purpose of the assessment the location of the Carbon Dioxide Delivery Terminal Compound within the Order Limits has been assumed as a worst case scenario. Additional assumptions for the assessment are discussed in **para 11.5.30**.

11.2. LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATIVE FRAMEWORK

11.2.1. The applicable legislative framework is summarised as follows.

National

The Water Environment (Water Framework Directive) (England and Wales) Regulations, 2017.

11.2.2. The overall objective of the Water Framework Directive (WFD) is to bring about the effective co-ordination of water environment policy and regulation across Europe. The main aims of the legislation are to ensure that all surface water and groundwater reaches 'good' status (in terms of ecological and chemical quality and water quantity, as appropriate), promote sustainable water use, reduce pollution and contribute to the mitigation of flood and droughts.

Groundwater Directive 2006/118/EC

11.2.3. The Groundwater Directive aims to set groundwater quality standards across Europe and introduce measures to prevent or limit pollution of groundwater, including those listed with the 'List of Priority Substances'. The Directive has been developed in response to the requirements of Article 17 of the WFD, specifically the assessment of chemical status of groundwater and objectives to achieve 'good' status.

Part 2A of the Environmental Protection Act (EPA), 1990

11.2.4. Part 2A of the Environmental Protection Act (EPA) 1990 (as amended) deals with contaminated land. This defines contaminated land as *"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substance in, on or under the land that;*

a) Significant harm is being caused or there is significant possibility of such harm being caused; or

b) Significant pollution to controlled waters is being caused, or there is a significant possibility of such pollution being caused."

Environment Act, 1995 (amend 2021)

11.2.5. The Environment Act 1995, and 2021 amendment provides a framework for improving environmental management across a wide spectrum of issues including water quality, nature and biodiversity and sets out liabilities relating to contaminated land. It aims to deliver long-term targets to improve environmental conditions and reduce pollution.

Control of Substances Hazardous to Human Health (COSHH), 2002

11.2.6. This law requires employers to control substances that are hazardous to health and outlines a precautionary approach to risk management with control strategies aiming to reduce exposure as much as possible.

Dangerous Substances Directive 2006/11/EC

11.2.7. The Directive focuses on pollution caused by certain substances discharged into the water environment and aims to reduce pollution of surface waters by these dangerous substances, which have been selected mainly on the basis of how toxic or persistent they are, including how much they may accumulate in organisms.

Control of Asbestos Regulations, 2012

11.2.8. The Control of Asbestos Regulations provide a framework for the management of asbestos / asbestos containing materials (ACMs) in existing non-domestic premises and during any work activity involving asbestos. Duty holders must make sure anyone who carries out any work in non-domestic premises and any occupants of the premises are not exposed to asbestos from ACMs that may be present.

Contaminated Land (England) Regulations, 2006

11.2.9. These Regulations make provision for the identification and remediation of contaminated land under Part 2A of the 1990 Act. The Regulations make provision for an additional description of contaminated land that is required to be designated as a special site.

Construction (Design & Management) Regulations, 2015

11.2.10. The Construction (Design & Management) (CDM) Regulations are the main set of regulations for managing the health, safety and welfare of construction projects. CDM applies to all building and construction work and includes new build, demolition, refurbishment, extensions, conversions, repair and maintenance.

Environmental Damage (Prevention and Remediation) Regulations, 2015

11.2.11. These Regulations oblige those who create environmental damage, whether by water pollution, adversely affecting protected species or sites of special scientific interest (SSSIs), or by land pollution that causes risks to human health, to not only cease the damage, but also to implement a wide variety of remedial measures to restore affected areas.

The Environmental Permitting (England and Wales) Regulations, 2016

11.2.12. These Regulations provide a system for permitting specified environmentally significant operations, a system of consenting of water discharges, a groundwater permitting system and a system of radioactive substances regulation. The Regulations require every regulated facility (as defined) to be operated under the authority of an environmental permit. The Regulations provide, among other things, for: the discharge of functions by the regulator in relation to permits, procedures for environmental permitting, enforcement notices and other enforcement measures and powers of the regulator.

Town and Country Planning (Development Management Procedure (England) Order) 2015

11.2.13. Planning authorities must consult Natural England on all non-agricultural applications that result in the loss of more than 20 hectares (ha) of best and most versatile land if the land is not included in a development plan. For example, this includes the likely cumulative loss of best and most versatile land from a proposed development if it's part of a phased development.

Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

11.2.14. Schedule 3.1.c of the Environmental Impact Assessment Regulations 2017 states that the EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on the following factors: land, soil, water, air and climate.

POLICY FRAMEWORK

11.2.15. The applicable policy framework is summarised as follows:

National

Draft and Overarching National Policy Statement (NPS) for Energy (EN-1)

11.2.16. At the time of writing, the Government is in the process of updating the Energy NPSs. The draft Outline National Policy Statement for Energy (EN1) was published in September 2021 (Department for Business, Energy and Industrial Strategy, 2021)**.** Accordingly, the current and draft versions of the NPSs have been considered as part of the EIA. Minimal changes have been made to the relevant aspects of the NPS and as such only reference to the draft NPS has been made below, however both have been considered. Further details are set out in paragraph 1.3.4 of **Chapter 1 (Introduction)** (document reference 6.1.1).

11.2.17. The Draft Overarching NPS EN-1 was published in September 2021 and explains the assessment principles to which the SoS will have regard in the examination of an energy NSIP (such as the Proposed Scheme) and explains the generic impacts with regard to energy infrastructure.

11.2.18. The relevant assessment principles in terms of generic impacts from Part 5 of NPS EN-1 ('Biodiversity and Geological Conservation', 'Land Use including Open Space, Green Infrastructure and Green Belt' and 'Water Quality and Resources) are set out below:

Draft NPS EN-1: Generic Impacts – Biodiversity and Geological Conservation

11.2.19. Paragraphs 5.4.3. to 5.4.4:

> "Where the development is subject to an EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance…The applicant should show how the project has taken advantage of the opportunities to conserve and enhance…geological conservation interests."

Draft NPS EN-1: Generic Impacts – Land Use including Open Space, Green Infrastructure and Green Belt

11.2.20. Paragraphs 5.11.5 to 5.11.12

> "Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as defined as grades 1, 2 and 3a of the Agricultural Land Classification and preferably use land in area of poorer quality (Grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination, and where contamination is present, applicants should consider opportunities for remediation where possible. Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination."
>
> "Applicants should safeguard any mineral resources on the proposed site as far as possible, taking into account the long-term potential of the land use after any future decommission has taken place."

NPS EN-1: Generic Impacts – Water Quality and Resources

11.2.21. Paragraphs 5.16.2 to 5.16.3

> "Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent…. Applicants are encouraged to consider protective measures to control the risk of pollution to groundwater beyond those outlined in Water Resource Management Plans……
>
> The ES should in particular describe…the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges…. any impacts of the proposed project on water bodies or protected areas …and source protection zones (SPZs) around potable groundwater abstractions."

National Planning Policy Framework

11.2.22. Chapter 15 of the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) (last updated 20 July 2021) set out the provisions for planning decisions in relation to ground conditions and pollution issues as follows:

11.2.23. Paragraph 174-part (b) states that:

> "Planning policies and decisions should contribute to and enhance the natural and local environment by recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland."

11.2.24. Paragraph 178 states that:

> "Planning policies and decisions should ensure that: a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination……";

11.2.25. Paragraph 179 states that:

> "Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rest with the developer and/or landowner."

11.2.26. Paragraph 180 states that

> "Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."

11.2.27. In addition, under Chapter 11 "Making effective use of land", Paragraph 118 states "Planning policies and decisions should: c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated and unstable land".

National Planning Practice Guidance

11.2.28. First published in March 2014 (and last updated on 1 October 2019), the Department for Communities and Local Government (DCLG) launched the National Planning Practice Guidance (NPPG) web-based resource. The following guidance from this resource are relevant to this chapter:

a. **Brownfield Land Registers** – provides guidance to local planning authorities in preparing and publishing brownfield land registers (DCLG, 2017);
b. **Land Affected by Contamination** – sets out the legislative regime for dealing with land that may be affected by contamination (DCLG, 2014);
c. **Land Stability** – sets out the requirement for consideration of land stability issues in planning (DCLG, 2014);
d. **Natural Environment** - encourages the use of brownfield land, planning policies and decisions should take account of the economic and other benefits of BMV land and soil is an essential natural capital asset (DCLG, 2016); and

e. **Water Supply, Wastewater and Water Quality** – consideration of the protection and enhancement of surface water and groundwater at the planning application stage (DCLG, 2015).

A Green Future: Our 25 Year Plan to improve the Environment (Defra, 2018)

11.2.29. This sets out the Government's 25-year plan to improve the health of the environment by using natural resources more sustainably and efficiently. It plans to: protect the best agricultural land; put a value on soils as part of our natural capital; manage soils in a sustainable way by 2030; and restore and protect peatland.

Local

Selby District Local Plan, Section 4: Environment (Selby District Council, 2005)

11.2.30. The key parts of Section 4: Environment of the Selby District Local Plan 2005 relate to contaminated land, groundwater protection, hazardous substances and Ancient Woodland, as follows:

Contaminated Land

11.2.31. The local plan states that it is the responsibility of developers to investigate, assess and mitigate risks associated with contaminated land, and to provide evidence of this to the Authority for the purpose of determining the DCO Application.

11.2.32. Section 4 of the Selby District Local Plan states the following in paragraph 4.43 in relation to contaminated land:

> "When contamination is known or suspected, developers will be required to undertake proper investigations to assess the nature and extent of contamination and applicants will be required to provide sufficient information to enable the Authority to determine the application. Effective measures must be incorporated to protect the public, property and natural resources from potential harmful effects."

Groundwater Protection

11.2.33. The Local Plan states that the Sherwood Sandstone aquifer is a principal source of drinking water in the region and that, due to the area of exposed aquifer, the groundwater is particularly sensitive to contamination. Planning permission will not be granted (or will be granted subject to conditions) where the proposals may give rise to groundwater contamination or other environmental pollution.

11.2.34. Section 4 of the Selby District Local Plan states the following in paragraphs 4.44 to 4.47 in relation to groundwater protection:

> "Groundwater stored in aquifers is a principal source of drinking water supply in the Plan area. Groundwater is also widely used by industry and agriculture, as well as feeding rivers and supporting wetlands which provide wildlife habitats. Both the quality and quantity of groundwater are legally protected...The Sherwood Sandstone underlying the Selby area is particularly sensitive to contamination due to the area of exposed aquifer…

11.2.35. General Policy ENV2: Environmental Pollution and Contaminated Land of the District Plan states:

> a) Proposals for development which would give rise to, or would be affected by, unacceptable levels of noise, nuisance, contamination or other environmental pollution including groundwater pollution will not be permitted unless satisfactory remedial or preventative measures are incorporated as an integral element in the scheme. Such measures should be carried out before the use of the site commences.
>
> b) Where there is a suspicion that the site might be contaminated, planning permission may be granted subject to conditions to prevent the commencement of development until a site investigation and assessment has been carried out and development has incorporated all measures shown in the assessment to be necessary."

Hazardous Substances

11.2.36. The Local Plan discusses that, as well as through the Planning (Hazardous Substances) Act 1990, it is appropriate to control risks relating to hazardous substances through the planning system. Proposals involving the storage or usage of hazardous substances will only be granted planning permission where there is no unacceptable risk to the public or natural environment and where opportunities for future development of land in the vicinity will not be severely restricted.

11.2.37. Section 4 of the Selby District Local Plan states the following in paragraphs 4.50 to 4.52 in relation to hazardous substances:

> "It is…appropriate to exercise careful planning controls over development involving hazardous substances in order to ensure that installations are kept separate from housing and other sensitive land uses such as schools and hospitals with which they may be incompatible…

11.2.38. General Policy ENV4: Hazardous Substances of the District Plan states:

> Proposals involving the storage or use of hazardous substances, or developments in the vicinity of sites where hazardous substances are being stored or used, will only be permitted where the District Council is satisfied that:
>
> 1) There is no unacceptable risk to the public or the natural environment; and
>
> 2) Opportunities for the development of land in the vicinity will not be severely restricted."

Selby District Core Strategy Local Plan, Section 7: Improving the Quality of Life (Selby District Council, 2013)

11.2.39. The key part of Section 7: Improving the Quality of Life of the Selby District Core Strategy Local Plan 2013, which relates to groundwater (paragraphs 7.24 to 7.26), is as follows:

> "The District contains significant groundwater supplies including both the Sherwood Sandstone aquifer and the Magnesian Limestone aquifer (which provides a vital water supply for the brewing industry in and around Tadcaster). There are also a number of wells for potable water abstraction in the southern part of the District which form part of a larger well-field for public supply. This water resource is already overcommitted.
>
> In some areas the protective drift material is missing and therefore the public water supply is very susceptible to contamination. Consideration must be given to the protection of water quality and prevention of pollution to the ground water supply.
>
> Climate change will lead to drier summers and wetter winters, increased flood risk in winter and a longer growing season. This will put increased pressure on related infrastructure and water resources. There is therefore a need to protect existing resources and encourage water conservation measures and encourage water efficiency to help the District adapt to climate change and ensure sufficient water resources to meet its needs."

Selby District Core Strategy Local Plan, Section 3: Vision, Aims and Objectives (Selby District Council, 2013)

11.2.40. Objective 17 states:

> "Protecting the best and most versatile agricultural land and enhancing the wider countryside for its important landscape, amenity, biodiversity, flood management, recreation and natural resource value."

11.2.41. An assessment of the relevant policies is detailed further in the **Planning Statement** (document reference 5.2).

11.3. CONSULTATION

11.3.1. **Table 11.1** provides a summary of the consultation undertaken in support of the preparation of this assessment.

Table 11.1 - Consultation Summary Table

Date and Method of Consultation	Consultee	Summary of Key Topics discussed and Key Outcomes
16 April 2021 (email)	Selby District Council (SDC)	The planning team within SDC confirmed that they were *"satisfied with the Applicant's proposed approach to scope in the construction phase and scope out the operational phase, as it is assumed that contaminants found during the construction phase will be remediated in line with the proposed uses"*. The planning team in SDC noted that they understand the PINS's concerns regarding the lack of evidence to back up the statements in the **EIA Scoping Report (Appendix 1.1)** (document reference 6.3.1.1) however are also comfortable with the approach taken by the Applicant as the chapter on ground conditions will be included within the ES and will outline mitigation likely to include a site investigation, risk assessment, remediation and verification. This will be unchanged by the inclusion of an assessment of the operational phase in the ES.
30 April 2021 (email)	Environment Agency (EA)	The EA provided information relating to ground conditions in response to a request for information from the Applicant.
1 November 2021 S42 Response	NYCC and SCC (Joint)	NYCC and SCC confirmed that the proposed approach and site investigation works mentioned in the Preliminary Environmental Information Report (PEIR) (WSP, October 2021) are acceptable.
10 December 2021 S42 Response	EA	Within the EA's S42 response no specific comments were provided directly referencing Chapter 11 Ground Conditions of the PEIR (WSP, October 2021). The EA provided 'Standing Advice' within regard to contaminated land.
10 December 2021 S42 Response	Natural England (NE)	NE confirmed that soil resources should be protected and used sustainably. They stated the ES should include an assessment of: ~ The degree to which soils are going to be disturbed / harmed as part of this development and whether "best and most versatile" agricultural land is involved. ~ If required, an Agricultural Land Classification (ALC) and soil survey of the land should be undertaken. This should normally be at a detailed level, e.g., one auger boring per hectare, (or more detailed for a small site) supported by pits dug in each main soil type to confirm the physical characteristics of the full depth of the soil resource, i.e., 1.2 m. ~ The ES should provide details of how any adverse impacts on soils can be minimised.
25 February 2022 (Virtual meeting)	NE	~ Methodology of the agricultural land and soil assessment was discussed with NE, and text provided to NE on 25 February 2022. Feedback was not received within the timescales of writing this ES. No concerns with the approach were raised during the meeting. ~ NE stated that the overall management of the soil resource within the Order Limits should be considered. The soils as a resource are discussed within the baseline **para 11.7.22 to 11.7.24** and an assessment is provided in **para 11.9.10 to 11.9.12**.

11.3.2. An **EIA Scoping Opinion (Appendix 1.2)** (document reference 6.3.1.2) was received by the Applicant from the Planning Inspectorate (PINS) on behalf of the Secretary of State (SoS) on 26 February 2021, including formal responses from Statutory Consultees. The responses from PINS in relation to Ground Conditions and how these requirements are addressed by the Applicant are set out in **Appendix 4.2 (Scoping Opinion Responses)** (document reference 6.3.4.2).

11.4. SCOPE OF THE ASSESSMENT

11.4.1. The scope of this assessment has been established through an ongoing Scoping process. Further information can be found in **Chapter 4 (EIA Methodology)** (document reference 6.1.4).

Elements Scoped Out of the Assessment

11.4.2. No environmental elements in relation to ground conditions have been scoped out for the Proposed Scheme.

Elements Scoped Into the Assessment

Construction Phase

11.4.3. The following elements are considered to have the potential to give rise to likely significant effects during construction of the Proposed Scheme and have therefore been considered within this assessment:

- **a.** Construction workers in relation to potential contamination within the underlying soils / groundwater during construction activities;
  - i. Controlled waters / Groundwater Dependant Terrestrial Ecosystems (GWDTE) during construction activities;
- **b.** Agricultural land impact from construction activities (e.g., physical removal of a soil resource or agricultural land, the permanent sealing of a soil resource or agricultural land, permanent or temporary loss or the reduction of one or more soil functions or restriction to current or approved future use, such as through degradation, compaction or erosion);
- **c.** Site users / workers in relation to potential contamination within the underlying soils / groundwater;
- **d.** Third party neighbours in relation to potential contamination within underlying soils / groundwater during construction activities; and
- **e.** Building structures in relation to potential contamination within the underlying soils / groundwater.

Operational Phase

11.4.4. The following elements are considered to have the potential to give rise to likely significant effects during the operational phase of the Proposed Scheme and have therefore been considered within this assessment:

a. Site users / workers in relation to potential contamination within the underlying soils / groundwater;
b. Third party neighbours in relation to potential contamination within underlying soils / groundwater during operational activities;
c. Controlled waters / GWDTE during operational activities;
d. Building structures and services (including water supply pipes) in relation to potential contamination within the underlying soils / groundwater during operational activities; and
e. Agricultural land impact from operational activities.

Decommissioning

11.4.5. The following elements are considered to have the potential to give rise to likely significant effects during decommissioning of the Proposed Scheme and have therefore been considered within this assessment:

a. Site users / workers in relation to potential contamination within the underlying soils / groundwater;
b. Demolition workers in relation in relation to potential contamination within underlying soils / groundwater during decommissioning activities;
c. Third party neighbours in relation to potential contamination within underlying soils / groundwater during decommissioning activities;
d. Controlled waters / GWDTE during decommissioning activities;
e. Building structures and structures (including water supply pipes) in relation to potential contamination within the underlying soils / groundwater during decommissioning activities; and
f. Agricultural land take from decommissioning activities.

11.4.6. **Chapter 12 (Water Environment)** assesses likely significant effects to Controlled Waters following the Design Manual for Roads and Bridges (DMRB) LA 113 (Highways England, 2020). As such, potential impacts relating to groundwater level and flow are assessed within **Chapter 12 (Water Environment)**.

11.5. ASSESSMENT METHODOLOGY

11.5.1. A qualitative assessment of potential effects that may arise during the construction phase, operational phase and decommissioning has been carried out that considers risks to ground conditions and associated sensitive receptors with reference to the activities for each phase as described in **Chapter 2 (Site and Project Description)** of this ES.

11.5.2. A **Phase 1 Preliminary Risk Assessment (Appendix 11.1)** has been undertaken to establish the current baseline condition of the study area (defined below in **Section 11.6 (Study Area)**) and assess potential constraints relating to land contamination relevant to the construction, operational and decommissioning phases of the Proposed Scheme.

11.5.3. The EA's guidance, Land Contamination Risk Management (LCRM)(Environment Agency, 2020), advocates the use of a conceptual risk model (Conceptual Site Model (CSM)). The basis of this approach comprises three elements: a source, a pathway and a receptor. Without each of these, there can be no contamination risk. Therefore, the presence of measurable concentrations of contaminants within the ground and subsurface does not automatically imply that a contamination risk exists, since the contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors that are relevant to a particular site will vary according to the intended use of the site, its characteristics and its surroundings. The potential for harm to occur requires three conditions to be satisfied:

a. The presence of substances (potential contaminants / pollutants) that may cause harm (the 'Source' of pollution);

b. The presence of a receptor that may be harmed (e.g., the water environment or humans, building, fauna or flora) (the 'Receptor'); and

c. The existence of a linkage between the source and receptor ('the Pathway').

11.5.4. Such an approach recognises that risks relating to land contamination can only exist where all three elements are present constituting a complete contaminant linkage.

11.5.5. LCRM will be used as a technical framework in the understanding of how contamination issues that may arise could be managed.

11.5.6. The CSM will be used to identify and assess the potential effects on the identified sensitive receptors (including human health, controlled waters, agricultural soils, ecological receptors, buildings and services) and outline mitigation measures to manage the risks identified in the assessment. The assessment has been prepared in accordance with the legislation and guidance referenced above.

11.5.7. The level of risk has been evaluated in accordance with the methodology set out in CIRIA C552: Contaminated Land Risk Assessment: A guide to good practice (CIRIA, 2001). This involves classification of the consequence and probability associated with each potential contaminant linkage and thereby the corresponding level of risk (risk category).

11.5.8. The framework for classifying of consequence, presented in full in Table 6.3 of CIRIA C552 (CIRIA, 2001), is summarised in **Table 11.2** below. The consequence classification does not depend on the probability that the consequence will be realised. The 'severe' consequence classification describes acute risk (arising from short-term exposure). The 'medium' classification describes chronic harm (and may constitute 'significant harm' under Part 2A (HMSO, 1990) of the Guide).

Table 11.2 - Qualitative Risk Assessment – Classification of Consequence

Classification	Definition
Severe	Severe short-term (acute) risks to human health, likely to result in significant harm.

Classification	Definition
	Short-term risk of pollution of sensitive water resource. A short-term risk to a particular ecosystem, or an organism forming part of such an ecosystem.
Medium	Chronic damage to human health (significant harm). Pollution of sensitive water resources. A significant change in a particular ecosystem, or an organism forming part of such an ecosystem.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings / structures / services or to the environment.
Minor	Harm, not necessarily significant, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health. Easily repairable effects of damage to buildings, structures and services.

11.5.9. The framework for classifying probability, presented in full in Table 6.4 of CIRIA C552 (CIRIA, 2001), is summarised in **Table 11.3** below.

Table 11.3 - Qualitative Risk Assessment – Classification of Probability

Classification	Definition
High Likelihood	There is a contaminant linkage and an event that appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	It is probable that an event will occur. Whilst not inevitable, it is possible in the short term and likely over the long term.
Low Likelihood	Circumstances are possible under which an event could occur, but it is not certain that (even over a long time period) such an event would occur.
Unlikely	It is improbable that an event would occur even in the very long term.

11.5.10. The level of risk (risk category), ranging from 'very high risk' to 'very low risk', is determined by the consequence and probability classifications using the matrix presented in full in Table 6.5 of CIRIA C552 (CIRIA, 2001) and shown in **Table 11.4** below.

Table 11.4 - Qualitative Risk Assessment – Risk Category

Probability	**Consequence**			
	Severe	**Medium**	**Mild**	**Minor**
High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

ALC Assessment

11.5.11. In order to categorise agricultural land receptor sensitivity, the methodology in DMRB LA 109 (Highways England, 2019) states that an ALC survey is required where data are not already available for agricultural land. The Ministry of Agriculture, Fisheries and Food (MAFF) revised guidelines and criteria for grading the quality of agricultural land (MAFF, 1988) lays out the methodology to assign Grades to agricultural land. The process considers site, climate and soil conditions at a site. Grades 1 and 2 and Subgrade 3a are considered to be the Best and Most Versatile (BMV) agricultural land, and Subgrade 3b and Grades 4 and 5 are non-BMV. An ALC survey was carried out within the Order Limits (in February 2022) where ALC data were not already available, and findings are provided in **Appendix 11.2** (**Soil Resource and Agricultural Land Classification Survey**).

11.5.12. In addition, a soil survey was carried out in the Off-Site Habitat Provision Area in the north section of Fallow Field to the south of Arthurs Wood. This area is not in agricultural use, the land will, however, be used for ecological mitigation.

11.5.13. With regards to potential contamination impacts to ALC grade, land is not graded higher than Subgrade 3b if it is considered to be unsuitable for growing crops for direct human consumption. Land which is limited to grass production and on which there are significant restrictions on grassland management will be no better than

Grade 4. Where only extensive grazing is possible the land will be Grade 5 and, where it is unfit for all forms of agricultural production, can be regarded as non-agricultural (MAFF, 1988).

ASSESSMENT OF SIGNIFICANCE

11.5.14. The significance of the effects for land contamination has been assessed by comparing the difference in risk for each contaminant linkage for baseline conditions to those at the construction phase, operational phase and decommissioning. Where there is shown to be a decrease in contamination risk the Proposed Scheme is assessed as having a beneficial effect on the environment in the long term.

11.5.15. The significance of effects to agricultural land is based on the permanent or temporary land take impacts or reduction in soil functions as a result of the Proposed Scheme.

Receptor Value / Sensitivity

11.5.16. Assessment of receptor value (sensitivity) for ground conditions follows the procedure described in **Table 11.5** which is set out in the DMRB Sustainability & Environmental Appraisal, LA 109 Geology and Soils (Table 3.11) (Highways England, 2019). Negligible sensitivity has been removed, as it is deemed irrelevant as no receptor (in terms of ground conditions) is classed as negligible.

11.5.17. Factors that may affect the sensitivity of the likely receptor include:

a. Human receptors: age, weight, sex, duration on-site and distance from the Site;

b. Controlled Waters receptors: distance from the Site and resource potential; and

c. Agricultural land and soil receptor: Resource quality, soil health and functions based on current or previous land uses.

11.5.18. Soils not categorised as BMV or prime land can be allocated a higher sensitivity category where particular agricultural practices contribute to the quality and character of the environment or local economy (e.g. in upland areas where lower quality agricultural land is integral to agricultural practices). No agricultural practices contributing to the quality and character of the environment or local economy were identified in the agricultural land and soil study area.

11.5.19. As described in **Chapter 8 (Ecology)** (document reference 6.1.8) , there are no EU designated sites, UK designated sites (e.g. SPA, Ramsar) or non-statutory designated sites (e.g. LGS, LNR) present within the Order Limits where sensitive soils could be directly affected by land take. Areas of non-designated notable / priority habitats including hedgerows, woodland (such as broad-leaved, coniferous) and grasslands are present within the Order Limits and Off-Site Habitat Provision Area, however, the soils within these habitats are not considered to be significantly or uniquely important to the development of or support these habitats.

Table 11.5 - Classification of Value (Sensitivity) of Resources

Receptor Value (Sensitivity) Importance	Criteria	Attribute	Typical Examples
Very High	Very rare and of international importance with no potential for replacement. Geology meeting international designation citation criteria which is not designated as such.	Geology	UNESCO World Heritage Sites, UNESCO, Global Geoparks, SSSI and Geological Conservation Review sites where citations indicate features of international importance
	Soils directly supporting an EU designated site. Agricultural land.	Agricultural land and soils	Special Area of Conservation (SAC) Special Protection Area (SPA), Ramsar ALC Grade 1 and 2
	Human health: very high sensitivity land use.	Contamination	Residential or allotments
	Nationally significant attribute of high importance.	Groundwater	Principal aquifer providing a regionally important resource and / or supporting a site protected under European Commission (EC) and UK legislation Ecology and Nature Conservation Groundwater locally supports Groundwater dependent terrestrial ecosystem (GWDTE) or Source Protection Zones (SPZ) 1
High	Rare and of national importance with little	Geology	Geological SSSI, National Nature Reserves (NNR)

Receptor Value (Sensitivity) Importance	Criteria	Attribute	Typical Examples
	potential for replacement. Geology meeting national designation citation criteria which is not designated as such.		
	Soils directly supporting a UK designated site. Agricultural land.	Agricultural land and soils	SSSI or National Nature Reserve. ALC Subgrade 3a
	Human Health: high sensitivity land use.	Contamination	Construction and maintenance workers (where extensive earthworks, and demolition of buildings are proposed) Public Open Space
	Locally significant attribute of high importance.	Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem Groundwater supports a GWDTE or SPZ2
Medium	Of regional importance with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	Geology	Regionally Important Geological Sites (RIGS)
	Soils supporting non-statutory designated sites. Agricultural land.	Agricultural land and soils	Local Nature Reserves (LNR), Local Geological Sites (LGS), Sites of Nature Conservation Importance (SNCI)

Receptor Value (Sensitivity) Importance	Criteria	Attribute	Typical Examples
			ALC Subgrade 3b
	Human Health: medium sensitivity land use.	Contamination	Construction workers (where limited earthworks, are proposed) Commercial or Industrial.
	Of moderate quality and rarity	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water SPZ3
Low	Of local importance / interest with potential for replacement	Geology	Non designated geological exposures, former quarries / mining sites
	Soils supporting non-designated notable or priority habitats. Agricultural land.	Agricultural land and soils	ALC Grade 4 and 5
	Low sensitivity land use	Contamination	Construction and maintenance workers (Minimal disturbance of ground) Infrastructure (roads, bridges, railways, buildings)
	Lower quality	Groundwater	Unproductive strata

Magnitude

11.5.20. The expected magnitude of impact to each identified attribute and receptor has been assigned in accordance with the principles established in DMRB LA 109 (Table 3.12) (Highways England, 2019) and DMRB LA 104 (Table 3.4N), along with professional judgement. The terms used to describe magnitude of impact are defined in **Table 11.6**.

Table 11.6 - Classification of Magnitude of Impact (Change)

Magnitude of Impact (Change)		Definition
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements. Less than 20 ha of Best and Most Versatile (BMV) Agricultural Land.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Between 20 and ≤50 ha of BMV agricultural land.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduce risk of negative impact occurring.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements; short-term exposure to contaminants with chronic (long-term) toxicity. Between 50 and ≤100 ha of BMV land.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements; exposure to acutely toxic contaminants. Greater than 100 ha of BMV agricultural land.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.

Significance Criteria

11.5.21. Once the sensitivity of the affected receptor / receiving environment to change and the magnitude of change have been established, the matrix presented in **Table 11.7**, which is based on Table 3.8.1 in DMRB LA 104 Environment Assessment and

Monitoring (Highways England, 2020), will be used to determine the significance of effect ranging from 'neutral' to 'very large'. The likely duration of the effect and likelihood of the effect occurring is also considered when assessing each effect.

11.5.22. Where a range has been provided, e.g., Moderate or Large, professional judgement has been used to define the significance. The effects are described as adverse and beneficial. An effect would be considered to be significant if assessed as moderate or above.

Table 11.7 - Significance of Effects Matrix

		Magnitude of Impact (Change)				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Receptor Value (Sensitivity)	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate

11.5.23. **Table 11.8**, which is based on Table 3.7 in DMRB LA 104 (Highways England, 2020), provides typical descriptions of these significance categories.

Table 11.8 - Significance Categories (Effects) and Typical Descriptions

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

TEMPORAL SCOPE

11.5.24. The assessment of environmental impacts relating to ground conditions will comprise:

a. Short (two to five years) and medium term (five to 10 years), temporary effects; and

b. Long term (10 to 15 years or more), permanent effects.

METHOD OF BASELINE DATA COLLECTION

Desk Study

11.5.25. The **Phase 1 Preliminary Risk Assessment (Appendix 11.1)** produced in October 2021 assesses the baseline conditions and develops a preliminary Conceptual Site Model of the Proposed Scheme, identifying potential sources of contamination, sensitive receptors and potential contaminant pathways.

11.5.26. Sources used to derive information for the desk study include:

a. Groundsure Report, ref: GSIP-2021-12199-7640, dated 25 August 2021 (Groundsure, 2021);

b. British Geological Survey (BGS) 'Onshore GeoIndex'. (accessed 24 August 2021)) (BGS, 2021);

c. BGS 'Geology of Britain' viewer (accessed 24 August 2021)) (BGS, 2021);

d. British Geological Survey (BGS) 1:63,360 / 1:50,000 Geological Map Series, New Series: Sheet No. 79 'Goole' (Drift ed.), 1971 (BGS, 1971);

e. British Geological Survey (BGS) 1:63,360 / 1:50,000 Geological Map Series, New Series: Sheet No. 79 'Goole' (Solid ed.), 1972 (BGS, 1972);

f. Flood Map for Planning Service (accessed 24 August 2021) (Environment Agency, 2021);

g. Defra's Multi-Agency Geographic Information for the Countryside MAGIC website (accessed 24 August 2021) (Defra, 2021);

h. Public Health England, UK Maps of Radon (accessed 24 August 2021) (Public Health England, 2021);

i. The Coal Authority Interactive Viewer (accessed 24 August 2021) (The Coal Authority, 2021);

j. Natural England, 2010. Agricultural Land Classification map 'Yorkshire & The Humber Region' (ALC003) (accessed 24 August 2021) (Natural England, 2021);

k. WSP, Drax Bioenergy with Carbon Capture Storage: Environmental Impact Assessment Scoping Report. For Drax Repower Ltd. Published January 2021. (WSP, 2021);

l. WS Atkins, 1965. Ref. 4235. Drax Power Station Main Station Site: Site Investigation Volume 2 (extract only) (factual exploratory hole logs and exploratory hole location plan supplied) (WS Atkins, 1965);

m. National Power, Ground Condition Information Manual, Drax Power Station, Flue Gas Desulphurisation, dated September 1996 (extract only) (National Power, 1996);

n. Dames and Moore, 2000. Figures and Exploratory Hole Records associated with ground investigation carried out in January 2000. Environmental Scientifics Group (ESG), 2011. Report No A1047-11. Drax Power Station – Project Phoenix. Desk Study. Carried out for: Drax Power Limited. June 2011 (Dames and Moore, 2000);

o. ESG, 2011. Report No A1047-11/2. Drax Power Station – Project Phoenix Report on Site Investigation, Volume 2. September 2011 (ESG/Soil Mechanics, 2011);

p. Alstom Power Systems S.A., 2014. White Rose Project Oxy Fired Coal & Biomass Power Plant. CPL Document Number 120103-S-CE-002. CPL Revision 02. October 2014 (Alstom Power Systems S.A., 2014);

q. ESG, 2014. Report No. A4048-14. White Rose CCS Project Site Raising, North Yorkshire. Factual Report on Ground Investigation. Carried out for Drax Power Ltd. Engineer: Parsons Brinckerhoff. October 2014 (ESG/Soil Mechanics, 2014);

r. Socotec UK Ltd, Drax Power Station, Selby, Geotechnical Desk Study, Reference A7101-7 dated December 2017 (Socotec, 2017);

s. Soils of the Market Weighton district (Soil Survey of England and Wales, 1987); and

t. Access to Evidence (Natural England, 2021).

Site Visit and Surveys

11.5.27. A site reconnaissance visit was undertaken on 28 September 2021.

11.5.28. An ALC Survey was undertaken on 10 February 2022, the outcome of which is reported on within the ALC Survey Report (Reading Agricultural Consultants Ltd, March 2022) provided in **Appendix 11.2** (**Soil Resource and Agricultural Land Classification Survey**).

Guidance and Data

11.5.29. The following guidance documents and data sources have been used during the preparation of this Chapter:

a. DMRB LA 104 Environmental Assessment and Monitoring, 2020 (Highways England, 2020);

b. DMRB LA 109 Geology and Soils, Highways Agency, 2019 (Highways England, 2019);

c. DMRB LA 113 Road Drainage and the Water Environment, 2020 (Highways England, 2020);

d. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D Publication 66, Volume 1, Environment Agency / National House-Building Council, 2008 (National House Building Council, 2008);

e. Construction Industry Research and Information Association (CIRIA) C552 (2001) Contaminated Land Risk Assessment. A Guide to Good Practice (CIRIA, 2001);
f. CIRIA C532 (2001) Control of Pollution from Construction Sites (CIRIA, 2001);
g. Environment Agency (2020) Land Contamination Risk Management (LCRM) (Environment Agency, 2020);
h. CIRIA C665 (2007) Assessing Risks Posed by Hazardous Gases to Buildings (CIRIA, 2007);
i. CIRIA C681 (2009) Unexploded Ordnance - A Guide for the Construction Industry (CIRIA, 2009);
j. International Standards Organisation, ISO 14001:2015 Environmental Management Systems (ISO, 2015);
k. Department for Environment Food & Rural Affairs (DEFRA) Contaminated Land Statutory Guidance (2012) (Defra, 2012);
l. CIRIA C733 (2014) Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks (CIRIA, 2014);
m. BS 5930:2015+A1 (2020) Code of Practice for ground investigations (British Standard, 2020);
n. BS 8485: 2015+A1 (2019) Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings (British Standard, 2019);
o. BS 10175:2011+A2 (2017) (British Standard, 2017);
p. EA (2017) Groundwater Protection Technical Guidance (Environment Agency, 2017);
q. Technical Information Note 049 (TIN049) (Natural England, 2012);
r. Safeguarding our Soils – A Strategy for England (Defra, 2009); and
s. Code of practice for the sustainable use of soils on construction sites (Defra, 2008).

Assessment Assumptions and Limitations

11.5.30. The following assumptions and limitations apply to this chapter:

Assumptions

a. Drax Power Station currently operates in accordance with Environmental Permits implemented under an environmental management system certified to ISO 14001:2015 as required by the Environmental Permitting Regulations 2016. The Applicant will submit a separate application for a variation to the existing Environment Permit, EPR/VP3530LS, for the Power Station. This will be developed in parallel to the DCO Application and submitted to the EA at the same time, or shortly after, the DCO Application is submitted to PINS.
b. It has further been assumed that the information provided and reviewed in the **Phase 1 Preliminary Risk Assessment (Appendix 11.1)** is representative of

existing ground conditions. A degree of professional judgement has been used in the interpretation of this information and in its application to determining environmental sensitivity and magnitude of impact.

c. The decommissioning of the Proposed Scheme would be undertaken in accordance with relevant legislation, permits (including the anticipated Environmental Permit required for operation the scheme) and good practice.

d. As described in **Chapter 2 (Site and Project Description)**, the Applicant has full planning permission for the demolition of the redundant Flue Gas Desulphurisation (FGD) Plant and associated restoration works at Drax Power Station (2020/0994/FULM). The decommissioning and demolition works of Absorber Units 4, 5 and 6 are scheduled to take place prior to the start of the construction of the Proposed Scheme, whilst the demolition of Absorber Units 1, 2 and 3 are assumed to take place following the completion of the Proposed Scheme. The demolition of Units 1, 2 and 3 are assessed in **Chapter 18 (Cumulative Effects)** (document reference 6.1.18).

e. The pipeline carrying CO_2 from the Carbon Capture Plant to Carbon Dioxide Delivery Terminal Compound will be partially constructed underground. It is assumed that this pipeline will transmit CO_2 in a liquid state at a temperature of approximately 20°C and will be placed at a depth of approximately 1 m bgl, above the groundwater table. As it will be pressurised (135 bar) it will be constructed so as to prevent failures/leaks along the length of the pipeline, and it is assumed that it will not transmit any hydrocarbons.

f. Detailed construction information is not yet available for the Proposed Scheme, and this assessment therefore draws on the professional experience of the assessor of other similar projects.

Limitations

a. The ALC survey is based on 1 auger point per hectare, therefore variations in texture may occur between the auger points which may not have been identified in the survey.

b. Previous ALC survey data have been utilised in the assessment of agricultural land, therefore the ALC survey carried out in February 2022 (Reading Agricultural Consultants Ltd, March 2022) targeted areas identified as data gaps based on the Order Limits identified at the time of the survey (February 2022).

11.6. STUDY AREA

11.6.1. The following study areas have been identified for this assessment:

a. A study area of 250 m from the Order Limits for ground conditions;

b. A study area of 1 km from the Order Limits for Controlled Water receptors or groundwater dependant terrestrial ecosystems only; and

c. The study area for the soil and agricultural land assessment applies to land to be disturbed within the Order Limits and the Off-Site Habitat Provision Area only.

11.6.2. These will be referred to as the ‘Order Limits’, ‘Off-Site habitat Provision Area’, ‘250 m study area’ and ‘1 km study area’.

11.6.3. The 250 m distance is referenced in best practice documents, including Guidance for the Safe Development of Housing on Land Affected by Contamination: R&D Publication 66 (National House Building Council, 2008), and is typical at the hazard identification stage of an assessment. Consideration has been given to the study area selected and, based on the Site specifics (such as the underlying geology, an appreciation of the water environment and previous land use) the buffer zone extends up to 1 km for Controlled Water receptors which is considered suitable. It should be noted that whilst the study area comprises the Order Limits plus an additional buffer zone up to 1 km, all applicable pollutant pathways and identified receptors located outside of the 1 km zone are included in the risk assessment.

11.6.4. The study areas are presented on **Figure 11.1 (Ground Conditions Study Areas and Superficial Geology)** (document reference 6.2.11.1).

11.6.5. If there is considered to be a potential for features outside of the study areas to be impacted by or to constrain the Proposed Scheme, then these have been included in the assessment. DMRB LA 109 (Highways England, 2019) guidance does not specify a minimum study area distance for the assessment of impacts to geology and soils / ground conditions. Impacts to agricultural land and soils are considered within the Order Limits and the Off-Site Habitat Provision Area only.

11.7. BASELINE CONDITIONS

EXISTING BASELINE

11.7.1. The major feature within the Site is the Drax Power Station, which remains operational in 2022. Drax is a large power station located south of the River Ouse. The Site is ‘lower tier’ classified under Control of Major Accident Hazards (COMAH).

11.7.2. The Site is otherwise predominantly rural and agricultural. The villages of Barlow, Camblesforth and Drax are located within 1 km of the Site.

11.7.3. Drax Power Station is served by a railway line which connects with the Pontefract line to the south. The major road infrastructure is the A645, located in the south of the Site on the southern perimeter of the power station. There are no fuel retail sites within the Site.

11.7.4. A site reconnaissance visit was undertaken by on 28 September 2021.

11.7.5. During the visit, six cooling towers were recorded on the Drax Power Station Site, in the northern part. A boiler house and turbine hall were noted in the centre of the Drax Power Station Site. In addition, large heavy fuel oil (HFO) storage tanks were present adjacent to the north of the boiler house and turbine hall.

11.7.6. The south-western extent of the Drax Power Station Site is dominated by a former coal storage area which is understood to be on a sand base. The area is underlain by a drainage network which discharges to the cooling water purge line to the north of the coal storage area. A small quantity of coal was noted to be stored; however, it was reported by a site representative that coal is no longer used and that the aim is to fully deplete the remaining supplies in the near future.

11.7.7. Drax Power Station railway line is present in the western part of the Drax Power Station Site, entering the south of the area, looping around the former coal storage area in the south-west of the Site and exiting in the south. This railway line is primarily utilised to import biofuels to the Power Station.

11.7.8. The BECCS plant is proposed to be constructed in the central western part of the Drax Power Station Site. This area is currently occupied by the FGD plant, as well as ash storage tanks. areas will be partially demolished prior to the construction of the BECCS plant.

11.7.9. The Carbon Dioxide Delivery Terminal Compound is proposed to be constructed in the northern part of the Drax Power Station Site (the former Woodyard area). Four sedimentation tanks are proposed in the east of the Drax Power Station Site to the west of the existing tanks. A pipeline (partially underground) will connect the Carbon Dioxide Delivery Terminal Compound to the Carbon Capture Plant.

11.7.10. The Habitat Provision Area, located to the north and north-east of the Drax Power Station Site is dominated by agricultural land with farm buildings located in the central and eastern part of the area.

11.7.11. The Off-Site Habitat Provision Area included within this assessment includes Arthurs Wood and the Fallow Field which are situated outside of the Order Limits. Arthurs Wood comprises an irregular area of woodland to the west of the Drax Power Station Site. The Fallow Field is adjacent to the south of Arthurs Wood and comprises an irregular parcel of land formerly used for agriculture.

11.7.12. The proposed East Construction Laydown Area is currently used as agricultural land.

HISTORICAL LAND USE

11.7.13. A summary of historical land uses which are pertinent to ground conditions within the Order Limits and the 250 m study area is provided in **Table 11.9.**

Table 11.9 - Summary of Historical Land Use

Historical Map (Scale and Date)	On-Site Feature(s)	250 m Study Area Feature(s)
1853 – 1855 (1:10,560) 1853 – 1854 (1:10,560) 1853 (1:10,560)	The Site is predominantly undeveloped agricultural land with the exception of Wood House in south east.	The 250 m study area is predominantly undeveloped agricultural land with occasional farm buildings. Drax Abbey and Site of the Priory of Drax are located in the central north of the Site (albeit outside of the Order Limits).
1890 (1:2,500) 1891 (1:10,560) 1907 (1:2,500) 1908 (1:10,560)	Lendall Drain running south-west to north-east in north east appearing to discharge to the River Ouse.	Carr Dyke drain is located adjacent to the west of the Site running east to west within an area 'liable to floods' before running adjacent to the Site in the west travelling north south along the western perimeter, turns and moves north-east through the centre of the Site. 'Fishpond' - located in the centre of the northern half of the Site (outside the Order Limits). Railway sidings run adjacent to the west and south west Order Limits. River Ouse running northwest to southwest to the Order Limits 30m to the north. Drax Station and fuel handling plant 100 m south east with railway sidings traversing south-west to north-east.
1950 (1:10,560) 1958 (1:10,560)	No significant changes.	Depot 220 m west.
1971 (1:2,500) 1972 (1:2,500) 1973 – 1974 (1:10,000)	Wood House replaced with multiple 'gantry's', a Tank and unlabelled buildings. Drax Power Station to the south of the Site including unspecified buildings and Chimney. Sewage Works and a Travelling Crane in the west. Sludge Lagoons and a drain traversing east west in centre. Pump House on bank adjacent to River Ouse in the north east.	The railway station sidings no longer exist 150 m south of the Site. A 'Dismantled Railway' is present running 150 m to the southwest boundary. Cooling Towers are present to the south. A Tank is located immediately to the south. Railway sidings traversing north south adjacent from the south west of the Site. Drax Station Goods Shed and railway sidings no longer exist to the south east. A Refuse Tip is present 80 m west of the Site. Electricity Sub-Station and Caravan Site adjacent east of the Site. Transformer and Electricity Sub-Station 225 m south west. Settling Tanks and Tanks 135 m west. Tank 250 m north west.
1982 (1:2,500) 1984 (1:2,500) 1982 – 1984 (1:2,500) 1982 -1987 (1:2,500) 1984 – 1989 (1:2,500) 1987 (1:2,500) 1987 – 1989 (1:2,500) 1988 (1:10,000)	Settling Ponds to the south of the Sewage Works in the west. Six cooling towers, multiple tanks, additional boiler and turbine hall, exhaust processing facilities and new unspecified buildings now present in the centre of the Power Station area. New road built with multiple large tanks in the east.	Depot 220 m west no longer present. Area labelled 'Ash Tip.' More unspecified buildings added in the south between southern cooling towers and coal field railway loop. Addition of three large circular tanks west of the cooling towers 90 m south of Site. Ponds 100 m south. Ponds 175 m south west. All tanks, the Incinerator and Pump House no longer exist in the northwest.

Historical Map (Scale and Date)	On-Site Feature(s)	250 m Study Area Feature(s)
1989 (1:2,500)		
1990 – 1994 (1:2,500) 1991 – 1994 (1:2,500) 1994 (1:2,500) 1994 – 1995 (1:2,500) 1995 (1:2,500)	Sewage Works no longer present in the west. New buildings and Tanks built in its place and immediately south until the Settling Ponds. Roundabout added in the very southern part of the Site. Additional unspecified buildings added west of the Cooling Towers in the centre of the Site. Surface water pond in the north west.	Ash Tip 100 m north west in Hook's Fields. Tank immediately south of the Site no longer exists. Replaced with a tennis court and bowling green. Two 'heaps' with an access road 170 m north west. Caravan Site and Electricity Sub-Station no longer present adjacent east of Order Limits.

GEOLOGY

11.7.14. The British Geological Survey (BGS) Map No. 72 (Goole, 1:63,360) (BGS, 1972) and the BGS online interactive viewer (BGS, 2021) indicates that the Site is underlain by superficial deposits comprising Alluvium, the Hemingbrough Glaciolacustrine Formation, the Breighton Sand Formation and Warp. The bedrock geology underlying the entire Site is recorded as the Sherwood Sandstone Formation.

11.7.15. There are no known regionally important geological sites (RIGS) located in the 250 m study area.

Artificial Ground (Made Ground)

11.7.16. It is highly likely that the study area contains Made Ground associated with all current and historical developments including the Drax Power Station Site. The study area contains rural and agricultural land and may therefore contain localised areas of artificial ground; for example, where depressions have been infilled to aid farming. These soils are likely to exhibit a certain degree of heterogeneity. The nature of the material can be expected to vary substantially in both composition and thickness over short distances. No known artificial ground is identified within the study area in the BGS 'Onshore GeoIndex' (BGS, 2021).

Superficial Deposits

11.7.17. The majority of the Site is underlain by the Hemingbrough Glaciolacustrine Formation (glacigenic silty clay) and the Breighton Sand Formation (fluvial and aeolian sands). These units were formed up to two million years ago in the Quaternary Period in a local environment characterised by ice age conditions.

11.7.18. The northern part of the Site (in the Habitat Provision Area) is underlain by alluvium (clay, silt, sand and gravel) associated with a minor tributary of the River Ouse. In the north extent of the Site, adjacent to the River Ouse, the superficial deposits comprise by warp (clay and silt). These units were formed up to two million years ago in the Quaternary Period in a local environment characterised by rivers.

Bedrock Geology

11.7.19. The Site is located on the East Midlands Shelf. In 1:50,000 geological mapping published by the BGS, the Site is shown underlain by the Sherwood Sandstone Group (SSG). This is sedimentary bedrock formed approximately 229 to 271 million years ago in the Triassic and Permian Periods in a local environment previously dominated by rivers, floodplain and lacustrine environments.

11.7.20. Publicly available BGS borehole logs from the Site were reviewed. The borehole records reviewed are summarised in **Table 11.10.**

Table 11.10 - Historical Borehole Records

Borehole Reference	Location (NGR)	Area – Direction within Area
SE62NE29	466694, 427703	Drax Power Station – North East
SE62NE30	466597, 427501	Drax Power Station – North East
SE62NE49	466671, 427102	Drax Power Station - East
SE62NE122	466054, 427753	Drax Power Station – North West
SE62NE123	466612, 428037	Habitat Provision Area - South
SE62NE124	466975, 428497	Habitat Provision Area - Centre
SE62NE125	467306, 428851	Habitat Provision Area - North
SE62NE126	466411 426629	Drax Power Station - East
SE62NE197	465870, 427760	Drax Power Station – North West
SE62NE198	466050, 427820	Drax Power Station – North West
SE62NE199	466140, 42790	Drax Power Station – North West
SE62NE200	466130, 427860	Drax Power Station – North West
SE62NE202	466310, 428000	Drax Power Station – North
SE62NE203	466490, 428020	Habitat Provision Area - South
SE62NE204	466630, 428110	Habitat Provision Area - South

11.7.21. The BGS borehole logs a were reviewed and a summary of the ground conditions in the logs is presented in **Table 11.11.**

Table 11.11 - Summary of Borehole Records

Strata	Depth to Top of Strata (mbgl)	Thickness (m)	Typical Strata Description
Made Ground	0.00	0.20 – 2.00	Topsoil Fill

Strata	Depth to Top of Strata (mbgl)	Thickness (m)	Typical Strata Description
Warp	0.40	9.66	Spongey peat with fragments of decaying timber Very silty clay and clayey silt
Alluvium	0.20 – 0.90	0.50 – 3.20	Mottled brown and grey silty clay Grey and brown clayey sand
Hemingbrough Glaciolacustrine Formation	0.00 – 10.05	0.50 – 17.10	Stiff laminated clay Stiff mottled red and grey clay
Breighton Sand Formation	0.90 – 17.40	1.00 – 4.10	Grey / brown sand
Sherwood Sandstone	18.75 – 20.00	Not proven	Sandstone

SOILS

11.7.22. Soils of the Market Weighton district (Sheet 106) at 1:50,000 scale shows Foggathorpe, Romney and Blacktoft series are dominantly present across the Site. Foggathorpe series consists of slowly permeable clayey pelo-stagnolgey soils, occasionally with a very thin medium loamy topsoil. Romney series consists of light silty gleyic calcareous alluvial soils, formed largely by artificial warping. These are generally well-drained by use of pumped dykes but can be prone to localised surface wetness from compaction. The Blacktoft series are calcareous medium silty soils, which are well structured (Soil Survey of England and Wales, 1987).

11.7.23. As described in **Chapter 8 (Ecology)**, there are no EU designated sites, UK designated sites (e.g., SPA, Ramsar) or non-statutory designated sites (e.g., LGS, LNR) present within the Order Limits where sensitive soils could be directly affected by land take. Areas of non-designated notable/priority habitats including hedgerows, woodland (such as broad-leaved, coniferous) and grasslands are present within the Order Limits, however, the soils within these habitats are not considered to be significantly or uniquely important to the development of or support these habitats.

11.7.24. Land south of Arthurs Wood (within the Off-site Habitat Provision Area) - Fallow Field (graded as 'other' in the February 2022 soil survey (Reading Agricultural Consultants Ltd, March 2022) is a rough grassland with reeds and bramble. Soil in this land parcel comprises stoneless, clay loams or clay, over a stoneless clay subsoil with slow permeability.

AGRICULTURAL LAND

11.7.25. Publicly available data shows BMV agricultural land (Grades 1 and 2 and Subgrade 3a) is present to the north / north-west of the Order Limits, as shown on Defra's MAGIC map post-1988 ALC (Defra, 2021)) (shown on **Figure 11.2 (Agricultural Land Classification Plan)**). The post-1988 ALC suggests there is a correlation between Romney and Blacktoft series and presence of BMV land, generally present alongside the bank of the River Ouse. The east of the Habitat Provision Area and the East Construction Laydown Area were shown as not surveyed on MAGIC maps.

11.7.26. An ALC survey was carried out in February 2022 (Reading Agricultural Consultants Ltd, March 2022) to survey the land within the East Construction Laydown Area as this is the only area of agricultural land proposed for construction works. The survey graded the land as Grade 2 (BMV) (4.9 ha) in the centre and Subgrade 3b (2.2 ha) on the northern and southern extents of the East Construction Laydown Area.

11.7.27. Land to the north of the East Construction Laydown Area within the Habitat Provision Area (shown on **Figure 1.2 (Indicative Site Layout Plan)** (document reference 6.2.1.2)) is proposed for mitigation and enhancement works including establishment of a seasonal / intermittently wet pond area, as set out in section 3 of the **Outline Landscape and Biodiversity Strategy** (document reference 6.6). This area has not been surveyed and is understood to be in agricultural use but is prone to seasonal flooding.

11.7.28. A figure of a (detailed) pre-1988 ALC survey shows land immediately west of the Habitat Provision Area to the north and east of the East Construction Laydown Area as being non-BMV land, based on anecdotal evidence from the land tenant. Extrapolating this data with the Reading Agricultural Consultants 2022 ALC survey findings suggests this section of the Habitat Provision Area is of Subgrade 3b.

HYDROGEOLOGY

11.7.29. The geological units on the Site and 1 km study area are assigned the following aquifer classifications by the EA:

- **a.** The Warp is a Secondary A Aquifer;
- **b.** The Alluvium is a Secondary A Aquifer;
- **c.** The Hemingbrough Glaciolacustrine Formation is unproductive strata;
- **d.** The Breighton Sand Formation is a Secondary A Aquifer; and
- **e.** The Sherwood Sandstone Group is a Principal Aquifer.

11.7.30. Shallow groundwater is likely to be present within the Warp and Alluvium strata, as well as the deeper Breighton Sand Formation and Sherwood Sandstone which may

be in hydraulic continuity. The Hemingbrough Glaciolacustrine Formation is classified as unproductive strata, and where present in sufficient thickness, is likely to act as an aquiclude restricting the vertical flow of groundwater between the shallow and deeper aquifers. Shallow groundwater (within the Warp and Alluvium) is considered likely to flow broadly towards the east / north east towards the River Ouse. Groundwater flow direction within the deeper groundwater (within the Breighton Sand Formation and Sherwood Sandstone) is likely to be greatly influenced by the abstraction boreholes (discussed in further detail below), and therefore the groundwater flow direction may vary over time. However, future ground investigation will confirm groundwater flow direction and gradient within both aquifers.

11.7.31. The WS Atkins (WS Atkins, 1965) data identifies groundwater strikes to have occurred at depths of between 6 m and 8 mbgl (rising to between 7.5 m and 2.5 mbgl). When monitored again at least four weeks after the ground investigation works, the data states that standing water levels of around 2 m – 3 mbgl were recorded (note these relate to pre-construction levels of the Drax Power Station in 1965). The Strata Surveys (2011) information indicates groundwater levels within the Order Limits to rest at approximately 3 m depth.

11.7.32. In the groundwater monitoring undertaken after the GI reported by ESG / Soil Mechanics in September 2011 (ESG/Soil Mechanics, 2011), for which the area of investigation was the coal stockpile area, the groundwater table was detected at 6.6 m - 13.5 mbgl (-0.57 m to 10.1 m AOD (m Above Ordnance Datum)). The groundwater monitoring was undertaken at seven borehole locations in July and August 2011.

11.7.33. The results of the groundwater monitoring reported by Alstom (Alstom Power Systems S.A., 2014) describe a stable groundwater table measured at -1 m to -5 m AOD between March and May 2014 across seven borehole locations in the north of the Drax Power Station Site.

11.7.34. The GI completed by Dames and Moore in January 2000 (Dames and Moore, 2000) encountered ‘shallow’ groundwater at 1.9 m to 4.57 m AOD (and inferred that ‘shallow’ groundwater flowed east and south east) and ‘deep’ groundwater at -3.3 m to -10.8 m AOD (and inferred that ‘deep’ groundwater flowed from south east to northwest.

11.7.35. The Applicant holds a licence for two active groundwater abstractions within the 250 m study area (Licence No. 2/27/24/199). These are located between 96 m (Borehole 2) and 188 m (Borehole 1) north west of the Order Limits. The record details that the abstractions are used for ‘General Use Relating to Secondary Category (Medium Loss)’ from boreholes within the Sherwood Sandstone.

11.7.36. In addition, a further two active groundwater abstractions are located within the 1 km study area both relating to abstraction for spray irrigation sourced from the Sherwood Sandstone; APS Growers Ltd (Licence No. 2/27/24/197) operate an abstraction point located 377 m southwest of the Order Limits and the Hambleton Abstraction Partnership hold a licence for an abstraction located 977 m north west of the Order

Limits (Licence No. NE/027/0024/003/R01). The EA provided details of two abstraction locations within the 250 m study area, between approximately 25 m and 200 m south of the Site, the abstractions are both recorded as being sourced from the Sherwood Sandstone and utilised for spray irrigation – direct.

11.7.37. The majority of the area within the Order Limits is located within a groundwater SPZ 3 (total catchment). The protected groundwater sources are located approximately 2 km to the south of the Order Limits at Carlton.

11.7.38. Further information about groundwater sources and abstraction points is provided in **Chapter 12 (Water Environment)**.

HYDROLOGY

11.7.39. The nearest major surface water feature is the River Ouse, located 30 m north of the Order Limits and is tidally influenced at the location of the Proposed Scheme. The river flows eastwards into the Humber Estuary. The River Ouse is a Main River as defined by the EA (a river for which the EA has powers to carry out maintenance, improvement or construction work to manage flood risk).

11.7.40. There are a number of field drains and other minor river channels within the Site, including Carr Dyke drain in the centre of the Site, Lendall Drain in the north of the Habitat Provision Area and a number of ponds (one adjacent to the north of cooling towers, two north west and one to the north of the Habitat Provision Area) associated with Drax Power Station and the Habitat Provision Area.

11.7.41. Surface water abstractions located within the Site are summarised in **Table 11.12**.

Table 11.12 - Surface Water Abstractions

NGR	Source	Details	Status
466300, 430300	River Ouse	Spray Irrigation – Direct	Historical
466300, 428000	Carr Dyke / Lendall Drain	Spray Irrigation – Direct	Historical
466998, 428510	Lendall Drain at Drax Abbey Farm	Spray Irrigation – Direct	Historical
466998, 428510	Lendall Drain at Drax Abbey Farm	Spray Irrigation – Direct	Active
467580, 428700	Tidal River Ouse – Long Drax	Process Water	Historical
467580, 428700	Tidal River Ouse – Long Drax	Boiler Feed	Historical

NGR	Source	Details	Status
467580, 428700	Tidal River Ouse – Long Drax	General Use	Historical

11.7.42. For further information on surface water features refer to **Chapter 12 (Water Environment)**.

FLOODING

11.7.43. The northern part of the Site, adjacent to the River Ouse, is located within Flood Zone 3, indicating a high probability of flooding. The central areas of the Site are located within Flood Zone 3 within an area that benefits from flood defences. The majority of the southern part of the Site (around Drax Power Station) is located within Flood Zone 1 indicating a low probability of flooding.

11.7.44. The Groundsure report (Groundsure, 2021) indicates the discrete areas across the Site are susceptible to surface water flooding with the highest risk being present in the centre of the Site which has a risk of flooding greater than 1 m with a return period of one in 30 years.

11.7.45. The Groundsure report indicates that the majority of the southern part of the Drax Power Station Site has a Moderate risk of groundwater flooding, whereas the northern portion of the Drax Power Station Site and the majority of the Habitat Provision Area have a high risk from groundwater flooding.

11.7.46. An area of agricultural land within the proposed Habitat Provision Area to the north of the East Construction Laydown Area has anecdotally been reported to flood intermittently during winter with an ephemeral pond forming.

11.7.47. For further information on flooding refer to **Chapter 12 (Water Environment)**.

ECOLOGICAL DESIGNATIONS

11.7.48. The 1 km study area includes the River Derwent SSSI and SAC which lies 450 m to the east of the Order Limits. There are non-statutory designated sites within the 1 km study area, namely Disused Railway Embankment SINC (no longer designated) 600 m east of to the Order Limits and Brockholes SINC located 700 m south east of the Order Limits. Based on the GWDTE Map of England (Environment Agency, n.d.), the closest GWDTE is the River Derwent SSSI.

11.7.49. For further information refer to **Chapter 8 (Ecology)**.

REGISTERED LANDFILLS

11.7.50. The following registered landfills are present within the 250 m study area:

a. New Road Landfill Site, located in the centre of the Site at the southern end of the Habitat Provision Area (license ref. 0700/NYCC/075, operational between

1978 and 1982). The landfill is recorded as accepting ‘non-biodegradable waste’ and ‘inert’ wastes;

b. Camblesforth By-Pass Tipping Site located adjacent to the south of the Site (licence ref. 0700/NYCC/076, operational between 1978 and 1982). The landfill is recorded as accepting inert and industrial wastes; and

c. Barlow Mound Ash Disposal Site located to the west of the Site and extending into the west of the Site. This is a ‘very large’ landfill (maximum input rate ≥ 250,000 tonnes per year) operational since 1977. Deposited wastes included industrial waste and principally pulverised fuel ash and furnace bottom ash.

RADON

11.7.51. Public Health England (Public Health England, 2021) records that the Site is located within a lower probability Radon area (less than 1 % of properties affected).

MINING

11.7.52. The Coal Authority interactive viewer (The Coal Authority, 2021) indicates that the northern part of the Site (predominantly in the Habitat Provision Area) is located within a coal mining reporting area.

11.7.53. The Groundsure report (Groundsure, 2021) contained within **Appendix 11.1 (Phase 1 Preliminary Risk Assessment)** indicates that the Site is not located within an area where non-coal mining activities have occurred.

11.7.54. Despite this, the Groundsure report reports a number of surface ground workings and British Pits located on the Site associated with a refuse heap, settling ponds and the production of pulverised fuel ash, desulphogypsum and furnace bottom ash by Drax Power Station.

SUMMARY OF PREVIOUS INVESTIGATIONS

11.7.55. WS Atkins, 1965. Drax Power Station Main Station Site Investigation Volume 2 (extract only) (factual exploratory hole logs and exploratory hole location plan supplied) (WS Atkins, 1965) :

a. A ground investigation was undertaken in 1965 prior to construction of Drax Power Station in 1975 and factual data was obtained (exploratory hole plan and records). No information on groundwater monitoring, in-situ testing or chemical laboratory test data was included within the information received by WSP.

11.7.56. National Power, Ground Condition Information Manual, Drax Power Station, Flue Gas Desulphurisation, dated September 1996 (extract only) (National Power, 1996):

a. Exploratory hole records associated with the ground conditions recorded beneath the Flue Gas Desulphurisation plant have been made available. There are two sets of exploratory hole logs; undertaken in 1988 and 1990, respectively. Unfortunately, the accompanying exploratory hole location plan is no longer available and therefore, a high-level and brief summary of the ground conditions recorded is presented. No information on groundwater monitoring, in-situ testing

or chemical laboratory test data was included within the report and as such cannot be commented on as part of the baseline assessment.

11.7.57. Figures and Exploratory Hole Records associated with ground investigation (GI) carried out in January 2000. Exploratory Hole Location Plan and Exploratory Hole Logs. Figures: Dames and Moore. Exploratory hole records drilled Cape Site Services in Sept 1999. Extract Only, No lab test data. (Dames and Moore, 2000)**:**

a. A GI commissioned by AES Electric Ltd. and undertaken by Dames and Moore. The GI was completed at Drax Power Station and reported in January 2000. This study included exploratory hole logs from various areas within the Drax Power Station Site. No other information, such as chemical laboratory data was included in the report and as such cannot be commented on as part of the baseline assessment.

11.7.58. ESG / Soil Mechanics Drax Power Station – Project Phoenix Desk Study Report No A1047-11 dated June 2011 (ESG/Soil Mechanics, 2011)**:**

a. In June 2011, Soil Mechanics was commissioned to complete a desk study by Drax Power (part of Project Phoenix). The study area was limited to the coal stockpile in the west of the Drax Power Station Site. Project Phoenix related to a historical redevelopment of the fuel storage area of Drax Power Station.

11.7.59. ESG / Soil Mechanics Drax Power Station – Project Phoenix Report on Site Investigation Volume 2: Interpretative Report, Report No A1047-11/2 dated September 2011 (ESG/Soil Mechanics, 2011)**:**

a. In September 2011, Soil Mechanics was commissioned to complete a GI by Drax Power Limited (part of Project Phoenix). The area of investigation was limited to the coal stockpile in the west of the Drax Power Station Site. The GI comprised advancement by cable percussion of 13 boreholes which were installed for groundwater and ground gas monitoring.

11.7.60. Strata Surveys Limited SCR and Unit 1 Reheater Drum Replacement Ground Investigation Report Revision A Reference 15142 dated September 2011 (Strata Surveys Limited, 2011)**:**

a. A site investigation was undertaken within the Drax Power Station Site in connection with the SCR scrubber unit and Unit 1 Reheater Drum replacement in order to provide information for foundation design. Three boreholes were advanced and plate bearing tests undertaken in order to confirm outrigger requirements for heavy mobile cranes. Two boreholes were also undertaken to the north of the main generator buildings and around the storage tank facility. Limited chemical analysis was undertaken as part of the investigation.

11.7.61. Alstom Power Systems S.A. White Rose Project Oxy Fired Coal and Biomass Power Plant Factual Report (April 2014) and Geotechnical Interpretative Report (October 2014) (Alstom Power Systems S.A., 2014)**:**

a. A phased GI was completed to generate geotechnical and hydrogeological data to inform conception of the biomass power plant at Drax Power Station. The area of investigation was in the north of the Drax Power Station Site. The results were subject to factual and interpretive reporting by Alstom in April and October 2014. Phase 1 of the GI was undertaken by Norwest Holst in 2009-2010 and comprised advancement of 10 boreholes, standard penetration testing (SPTs), mechanical excavation of 24 trial pits and completion of 10 cable percussion tests. The results were reported within the interpretive reporting completed by Alstom in October 2014. Phase 2 of the GI was undertaken and reported by Structural Soils in 2014 and comprised advancement of 36 cable percussion boreholes (of which 11 were extended by rotary drilling), three rotary open hole boreholes, permeability testing, cone penetration testing (CPTs) and geophysical testing to aid interpolation between exploratory locations. Seven of the boreholes were installed for groundwater monitoring and subject to eight groundwater monitoring rounds between March and May 2014. A number of soil and groundwater samples were collected for geotechnical purposes. The results were factually reported by Structural Soils in May 2014 and included within the interpretive reporting completed by Alstom in October 2014.

11.7.62. ESG / Soil Mechanics White Rose CCS Project Site Raising, North Yorkshire, Factual Report on Ground Investigation Reference A4048-14 dated October 2014 (ESG/Soil Mechanics, 2014)**:**

a. In May 2014, Environmental Scientifics Group (ESG) was commissioned by Parsons Brinckerhoff on behalf of Drax Power Limited to carry out a GI at Drax Power Station. The investigation sought to obtain geotechnical and geo-environmental data in the area of Hook's Fields, in the north of the study area. The GI included mechanical excavation of eight trial pits and hand excavation of two trial pits and environmental sampling and analysis for potential contaminants.

11.7.63. Socotec UK Ltd, Drax Power Station, Selby, Geotechnical Desk Study, Reference A7101-7 dated December 2017 (Socotec, 2017):

a. In November 2017 Socotec UK Limited (formerly known as ESG) was commissioned by Drax Power Limited to carry out a geotechnical desk study for a site within Drax Power Station, Selby, North Yorkshire.

b. The report includes a summary and collation of ground conditions the previous ground investigations listed above. No quantitative chemical data is included relating to contaminated land.

c. Ground conditions across the Drax Power Station Site are reported to be Made Ground of various composition up to 4 m thick. Made Ground deposits are underlain by Hemingbrough Glaciolacustrine Formation across the Site approximately 4 m in thickness (-9 m AOD to -13 m AOD). The Breighton Sand

Formation overlies the Hemingbrough Glaciolacustrine Formation locally and is similar in composition. The Sherwood Sandstone Group underlies the Hemingbrough Glaciolacustrine Formation and was proven to depths of -12.5 m AOD to -16 m AOD.

d. Socotec inferred that (based on the Dames and Moore Report, (Dames and Moore, 2000)) shallow groundwater is likely to be perched above the Hemingbrough Glaciolacustrine Formation within Made Ground. Deeper groundwater within the Sherwood Sandstone Group is influenced by the ground abstractions at the south west corner of the power station.

POTENTIAL SOURCES OF CONTAMINATION

11.7.64. **Table 11.13** provides a summary of the potential sources of contamination that may be present at the Site based on the historical use of the site and their potential contaminant uses, as well as the likely nature of such sources.

Table 11.13 - Potential Sources of Contamination

Potential Source	Potential Contaminants of Concern
On-Site	
Made Ground associated with historical development on the Site and landfilling	Petroleum hydrocarbons, Benzene, Ethylbenzene, Toluene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), heavy metals, inorganics (e.g., cyanide), asbestos and ground gas (carbon dioxide and methane) and vapours.
Drax Power Station and associated processes	Range of contaminants including petroleum hydrocarbons, PAHs, heavy metals, VOCs, SVOCs and inorganics.
Historical Sewage Works including sludge lagoons and settling ponds	Asbestos, heavy metals, inorganics, petroleum hydrocarbons, PAH, pathogens, pesticides.
Various tanks	Depending on contents, range of contaminants including petroleum hydrocarbons, mineral oils, and /or PAHs.
Railway sidings	Asbestos, petroleum hydrocarbons, BTEX, Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), heavy metals, inorganics (e.g., cyanide), creosotes and phenols.
Agricultural land uses	Inorganics, pesticides and fertilisers.

Potential Source	Potential Contaminants of Concern
Within the 250 m Study Area	
Made Ground and Landfilling	Petroleum hydrocarbons, Benzene, Ethylbenzene, Toluene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), heavy metals, inorganics (e.g. cyanide), asbestos and ground gas (carbon dioxide and methane) and vapours.
Various tanks	Depending on contents, range of contaminants including petroleum hydrocarbons, mineral oils, PAHs.
Various ash and refuse tips	Asbestos, heavy metals and PAH.
Historical land uses including: Railways / sidings / station Goods shed Depots	Asbestos, petroleum hydrocarbons, BTEX, Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), heavy metals, inorganics (e.g., cyanide), creosotes and phenols.
Transformers and Substations	Polychlorinated biphenyls (PCBs) and mineral oils.

POTENTIAL PATHWAYS

11.7.65. Potential pathways include:

- **a.** Direct / dermal contact, ingestion or inhalation of soil bound contaminants / dust;
- **b.** Inhalation of vapours associated with volatile organic compounds;
- **c.** Inhalation of respirable asbestos fibres;
- **d.** Leaching of contamination into groundwater from soil followed by lateral migration of groundwater to the wider groundwater environment or surface waters;
- **e.** Migration of gases / groundwater through preferential pathways such as utility service trenches / ducts; and
- **f.** Direct / dermal contact with potentially impacted groundwater.

SENSITIVE RECEPTORS

11.7.66. The following potential receptors have been identified:

Human Health

a. Site users e.g., site visitors, and workers;

b. Construction and demolition workers; and,

c. Third party neighbours.

Controlled Waters

a. Groundwater within the Breighton Sand Formation, Alluvium and Warp (Secondary A Aquifers) and the Sherwood Sandstone Formation (Principal Aquifer); and,

b. Surface Water (e.g., River Ouse, Carr Dyke and Lendall Drain).

Building Fabric and Services

a. Below ground services; and,

b. Building structures.

Other

a. Agricultural land; and

b. Ecological receptors (GWDTE).

CONCEPTUAL SITE MODEL

11.7.67. On the basis of the baseline conditions, a preliminary conceptual site model has been developed in the context of the Proposed Scheme. The level of risk has been evaluated in accordance with the methodology set out in CIRIA C552: Contaminated Land Risk Assessment: A guide to good practice (CIRIA, 2001). This involves classification of the consequence and probability associated with each potential contaminant linkage and thereby the corresponding level of risk (risk category). The conceptual site model is presented in **Table 11.14**.

Table 11.14 - Conceptual Site Model

Sources	Pathways	Receptors	Consequence	Probability	Risk
Made Ground associated with historical development on the Site and landfilling. Drax Power Station and associated processes Historical Sewage Works including sludge lagoons and settling ponds Various tanks Railway sidings Agricultural land uses Off-site sources including ash tips, landfills, sidings, substations and depots	Ingestion, inhalation and dermal contact with contaminated soil or dust. Inhalation of asbestos fibres. Ingestion of contaminated water.	Human Health (e.g., site users, construction and demolition workers and third party neighbours).	Medium	Low Likelihood	Moderate / Low Risk
	Lateral migration of aqueous and dissolved contaminants via groundwater flow, overland or preferential pathways.	Surface water (e.g., River Ouse, Carr Dyke and Lendall Drain) and Ecological receptors (Groundwater Dependant Terrestrial Ecosystems)	Medium	Low Likelihood	Moderate / Low Risk
	Vertical migration of aqueous and dissolved contaminants through Made Ground strata or via preferential pathways.	Groundwater: Breighton Sand Formation, Alluvium and Warp (Secondary A Aquifers) and the Sherwood Sandstone Formation (Principal Aquifer)	Medium	Low Likelihood	Moderate / Low Risk
	Inhalation of hazardous ground gases or vapours.	Human Health (e.g., site users, construction and demolition workers and third party neighbours).	Medium	Unlikely	Low Risk
	Chemical attack and degradation (buried concrete structures).	Below ground services and building structures.	Mild	Low Likelihood	Low Risk
	Migration of potential contaminants within soils or groundwater onto agricultural land.	Agricultural land	Mild	Low Likelihood	Low Risk

FUTURE BASELINE

11.7.68. Other than the above potential Site conditions (**Table 11.14**), in the absence of the Proposed Scheme, it is likely that the Site conditions would remain as they are reported within this Chapter.

11.8. SENSITIVE RECEPTORS

11.8.1. The following sensitive receptors have been assessed:

Table 11.15 - Resource Value (Sensitivity)

Resource / Receptor	Resource Value (Sensitivity)	Justification
Agricultural land	Very High	A portion of the site is Grade 2 (BMV) agricultural land, as defined in the NPS EN-1. No other sensitive soil receptors, such as peat deposits or unique soils directly supporting ecological receptors have been identified.
Controlled Water: Hemingbrough Glaciolacustrine Formation	High	The Hemingbrough Glaciolacustrine Formation is an aquiclude. However, it is underlain by The Sherwood Sandstone Group (Principal aquifer). The majority of the Site is located within a groundwater SPZ 3 (total catchment). The leaching potential of overlying soils is intermediate or high.
Controlled Water: Breighton Sand Formation	High	The Breighton Sand Formation is a Secondary A aquifer. However, it is underlain by The Sherwood Sandstone Group (Principal aquifer). The majority of the Site is located within a groundwater SPZ 3 (total catchment). The leaching potential of overlying soils is intermediate or high.
Controlled Water: Alluvium and warp	High	The alluvium and warp are Secondary A aquifers. However, they are underlain by The Sherwood Sandstone Group (Principal aquifer). The majority of the Site is located within a groundwater SPZ 3 (total catchment). The leaching potential of overlying soils is intermediate or high.
Controlled Water: Sherwood Sandstone Group	High	The Sherwood Sandstone Group is a Principal aquifer. Groundwater stored in aquifers is a principal source of drinking water in the area. The majority of the Site is located within a groundwater SPZ 3 (total catchment). The leaching potential of overlying soils is intermediate or high.
Controlled Water: River Ouse (Main River)	High	The River Ouse is a Main River as defined by the EA.
Controlled Water: Field Drains	High	There are a number of field drains and other minor watercourses within the Site including Carr Dyke and Lendall Drain. These drain into the River Ouse which is a Main River as defined by the EA.
Groundwater Dependant Terrestrial Ecosystems (GWDTE)	High	The River Derwent SSSI and SAC lies 450 m to the east of the Order Limits. The River Derwent SSSI is also a GWDTE.
Below ground services	Medium	The built environment within the Site includes utility service as except for potable water supply pipes, utility services are not adversely affected by contamination.
Building Structures	Low	This includes the Drax Power Station Site and other buildings, services and foundations, as well as proposed structures.
Site Users / Workers	Low	Site users / workers are unlikely to be present within areas of earthworks and construction / decommissioning and therefore less likely to come into contact with potentially contaminated soils and groundwater. Additionally, it is assumed that the Drax Power Station Site is operated in accordance with all relevant legislation, guidance and best practice, which will mitigate occupational risks to power station personnel.
Construction / Demolition Workers	Medium	Limited earthworks will be required as part of the Proposed Scheme which may bring construction / demolition works into contact with potentially contaminated soils and groundwater. However, it is assumed that the construction and decommissioning phases will be undertaken in accordance with all relevant legislation, guidance and best practice, which will mitigate occupational risks to construction and demolition workers during works on the Power Station Site.
Third Party Neighbours	Low	Third party neighbours are unlikely to be within influence of the areas of construction (> 250 m distant) which include significant disturbance of ground during construction / decommissioning. Additionally, it is assumed that the construction and decommissioning phase will be undertaken in accordance with all relevant legislation, guidance and best practice, which will mitigate risks to third party neighbours during construction and decommissioning of the Proposed Scheme.

11.8.2. Controlled waters, GWDTE and agricultural soil sensitive receptor locations are shown on **Figure 2.1 (Environmental Constraints)** (document reference 6.2.2.1), **Figure 11.1 (Ground Conditions Study Areas and Superficial Geology)** and **Figure 11.2 (Agricultural Land Classification Plan)** (document reference 6.2.11.2).

11.9. PRELIMINARY ASSESSMENT OF LIKELY IMPACTS AND EFFECTS

11.9.1. This section details the preliminary assessment of significant effects taking account of primary and tertiary mitigation, as described in **Chapter 2 (Site and Project Description),** but in the absence of secondary mitigation. Secondary mitigation for the Proposed Scheme is described in **Section 11.10.3** below.

11.9.2. Those effects that have been determined to be not significant in the preliminary assessment of likely impacts and effects have been reported in **Appendix 11.3 (Effects that have been determined to be not significant)** (document reference 6.3.11.3).

11.9.3. The preliminary environmental assessment reported within the Preliminary Environmental Information Report (PEIR) (WSP, October 2021) for Ground Conditions receptors associated with the decommissioning phase assessed that there would not be significant effects as a result of the Proposed Scheme during decommissioning. This assessment remains valid and is provided in **Appendix 11.3 (Effects that have been determined to be not significant)**. The highest level of effect anticipated is **slight adverse** (not significant).

CONSTRUCTION PHASE

11.9.4. The likely significant effects for Ground Conditions associated with the construction phase are set out below.

Effects on Construction Workers from Potential Contamination within the Underlying Soils / Groundwater

11.9.5. There is a potential for hazardous substances to be present within underlying soils and groundwater due to historical site uses, in particular within the Drax Power Station Site. Construction workers and site users / workers could be exposed to any contaminants that are present in the Made Ground, including asbestos fibres during construction and decommissioning. They would be affected by inhalation of dusts, gases or vapours, dermal contact with soil and groundwater and ingestion of soil and dust. However, the length of direct exposure would be limited to the duration of works in which they are directly involved, and thus the effect would be short term. Any health effects from the potentially contaminated soil and groundwater could have a medium to long term effect.

11.9.6. The sensitivity of construction workers is medium and the magnitude of impact, prior to mitigation, is moderate. Therefore, there is likely to be a direct, permanent, medium to long-term **moderate adverse** effect (significant) on construction workers prior to the implementation of mitigation measures (see **Section 11.10**).

Effect to Controlled Waters / GWDTE

11.9.7. There is the potential for soils and groundwater impacted by contaminants to be present within the Order Limits due to the nature of historical site use. Construction phase activities (such as drilling, piling, and excavation) have the potential to create new migratory pathways through which contaminants could migrate into underlying aquifers and ultimately the River Ouse and GWDTE (which are likely to be in hydraulic connection with the groundwater). There is also potential for construction phase activity to introduce contaminants to the study area (for example, due to ineffective control of fuel). This could result in **adverse** impacts to groundwater during the construction phase, particularly if new migratory pathways have been created, but these impacts are less likely to persist beyond the construction phase.

11.9.8. The sensitivity of Controlled Waters and GWDTE is considered to be high, and the magnitude of change, prior to mitigation is minor. Therefore, there is likely to be a direct, temporary, long-term slight or **moderate adverse** effect (significant) on Controlled Waters and GWDTE prior to the implementation of mitigation measures (see **Section 11.10**).

Effect on agricultural land

11.9.9. As detailed in **paragraph 11.7.25 to 11.7.28** above, BMV agricultural land (Grades 1 and 2 and Subgrade 3a) is present within the Habitat Provision Area, however no construction works are proposed within the Habitat Provision Area.

11.9.10. The potential impact to agricultural land from construction activities is limited to the East Construction Laydown Area as it includes 7.1 ha of Grade 2 BMV (4.9 ha) and Subgrade 3b (non BMV) (2.2 ha) agricultural land. During construction, agricultural soils within East Construction Laydown Area can be degraded due to construction activities without appropriate mitigation through compaction and erosion. The total area of agricultural land considered to be affected by the construction phase is therefore 7.1 ha.

11.9.11. The sensitivity of agricultural land is considered to be very high and the magnitude of change, prior to mitigation is minor adverse. Therefore, there is likely to be a direct, temporary, long-term **moderate or large** effect (significant).

OPERATIONAL PHASE

11.9.12. The preliminary environmental assessment reported within the Preliminary Environmental Information Report (PEIR) (WSP, October 2021) for Ground Conditions receptors associated with the operational phase assessed that there would be no significant effects as a result of the Proposed Scheme. This assessment remains valid and is provided in **Appendix 11.3 (Effects that have been determined to be not significant)**. The highest level of effect anticipated is **slight adverse** (not significant).

11.9.13. Changes to the Proposed Scheme since the production of the PEIR include a proposed seasonal / intermittently wet pond area and establishment of species rich

grassland (see **Section. 3.3** of the **Habitat Regulations Assessment Report** (document reference 6.8.1) within a 5.05 ha area of land to the north of the East Construction Laydown Area (the Habitat Provision Area). An ALC survey has not been undertaken for this area however it is likely to be Grade 3b (non BMV) and it is proposed that this area will be permanently allocated for ecological mitigation only. This change to the Proposed Scheme has been assessed as having no significant effect with regard to agricultural land and the assessment is provided within **Appendix 11.3 (Effects that have been determined to be not significant)**.

11.10. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

11.10.1. This Section sets out the design, mitigation and enhancement measures which are likely to be required to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment.

DESIGN

11.10.2. No additional measures over and above the primary mitigation measures outlined in **Chapter 2 (Site and Project Description)** would be required.

MITIGATION

11.10.3. A **Register of Environmental Actions and Commitments (REAC)** (document reference 6.5)has been produced for the Proposed Scheme. The **REAC** would be secured by a requirement to the DCO and would include a requirement for a Construction Environmental Management (CEMP) to be produced for the Proposed Scheme. The CEMP would include the following measures which would be implemented to mitigate risks to human health (site visitors / workers, construction / demolition workers and, third party neighbours), Controlled Waters and GWDTE and agricultural soils:

a. General good construction working practices would be implemented such as dust suppression, including potentially contaminated dust, (damping down), windbreak netting around excavations and / or perimeter fencing, covering stockpiles with tarpaulins, wheel washing and road sweeping to prevent local residents and employees in the vicinity of the earthworks from being exposed to windblown dusts, vapours and asbestos fibres;

b. Appropriate stockpile segregation, locations and containment measures would be implemented to minimise the exposure of surface water and groundwater from contaminated run-off and local neighbours from windblown dusts, vapours and asbestos fibres;

c. A protocol for managing unexpected ground contamination that may be encountered during construction would be implemented. This may require additional investigations, sampling, risk assessment and remediation to ensure the protection of the possible receptors;

d. Construction workers would be required to wear PPE such as gloves and face masks (where appropriate) to prevent dermal contact and inhalation or ingestion.

Appropriate site hygiene facilities will be put in place and the presence of contaminants and the associated risks will be explained to ground workers before they begin work;

e. Fuel storage on-site would be carried out under best practice i.e. integrally bunded containers. Plant refuelling would be carried out using best practice techniques and any spills to be controlled with spill kit;

f. Management of water that collects on Site or within excavations would be implemented;

g. Appropriate management plan for polluting substances that are being brought on Site and used as part of the construction process would be implemented;

h. Appropriate management plan for sediments in surface water runoff generated in construction area and laydowns would be implemented;

i. Appropriate management plan of accidental leakage and / or spillage incidents of oils / hazardous substances would be implemented;

j. Incorporation of hydrocarbon interceptors into the Site drainage system at high-risk areas, such as parking, unloading and refuelling areas, to remove hydrocarbons and oils from surface water prior to discharge would be implemented; and

k. A Soil Handling Management Plan would be produced prior to any enabling or construction works commencing. This will describe best practice methods to reduce impacts to soil during handling and would be informed by site-specific soil and climatological data. This would include details on stripping methods, stockpiling requirements, appropriate management (including weather conditions during handling, seeding of stockpiles, stockpile heights etc) and reinstatement. Land to be restored for agricultural use after construction would require an agreed aftercare plan with the landowner / farmer and aim to return the land to the same agricultural capability as before construction. In addition, best practice construction methods would be included in the CEMP to provide methods of minimising the temporary loss or reduction of soil functions (i.e., dust mitigation measures).

Ground Investigation

11.10.4. A ground investigation would be undertaken prior to the construction phase. This is likely to be led by geotechnical requirements but would include geo-environmental sampling of soil, groundwater, and surface water. The scope of the geo-environmental investigation would be underpinned by the CSM presented in the **Phase 1 Preliminary Risk Assessment** (**Appendix 11.1**). The analytical data would be screened for risks to human health and controlled waters and the results used to refine the contaminant linkages identified. The soils will also be analysed for the purposes of waste classification and to determine suitability for re-use.

11.10.5. The ground investigation would also confirm preliminary hydrogeological conditions and will obtain information associated with ground aggressivity, including sulphates,

sulphides (especially in pyritic ground), water-soluble magnesium and acids (indicators are pH, chloride and nitrate ions). The results will be used to determine an appropriate concrete specification for the design stage.

11.10.6. The ground investigation would be undertaken in accordance with the following:

a. BS 10175:2011+A2:2017: Investigation of Potentially Contaminated Sites. Code of Practice. British Standards Institute (British Standard, 2017); and

b. Land Contamination Risk Management, Environment Agency (Environment Agency, 2020).

11.10.7. The results of the ground investigation would be interpreted and assessed within a Generic Quantitative Risk Assessment (GQRA) which will be provided for regulatory approval.

11.10.8. If the ground investigation identifies contaminant linkages a Remediation Strategy would be produced which would specify protective measures during construction which would be agreed with the regulators prior to implementation. The Remediation Strategy would include measures to remove or decommission any below ground services, tanks, structures and / or pipework encountered during construction to ensure that contaminants do not enter the ground and no preferential pathways remain.

11.10.9. Any remediation undertaken would be validated and report on within a Verification Report to provide confidence that it has been undertaken with the agreed strategy.

11.10.10. A Piling Risk Assessment would be produced to outline measures to protect the underlying aquifers during Construction and mitigate risk of creating preferential pathways for potential contamination.

11.10.11. An Earthworks Specification would be produced that would include protocols for testing and limiting values to ensure that imported materials are suitable for their intended use in terms of their chemical and geotechnical quality.

11.10.12. Contaminated ground materials that cannot be reused would be suitably managed to prevent mobilisation to the environment and to minimise the potential to impact sensitive receptors, prior to disposal. A Materials Management Plan would be produced, if necessary, following the Contaminated Land: Applications in Real Environments (CL:AIRE) ‘Definition of Waste: Development Industry Code of Practice’ (CL:AIRE, 2011) and / or exemptions / environmental permits, to ensure that soil re-use and imported materials are suitable for their intended use and will not significantly affect human health or the environment.

11.10.13. The above mitigation is secured by way of a requirement in Schedule 2 of the **draft DCO** (document reference 3.1).

Opportunities for Environmental Enhancement

11.10.14. As detailed in **para 11.10.4**, a ground investigation would be undertaken before construction to inform detailed design. Depending on information gathered through this ground investigation, monitoring of groundwater and surface water may be

recommended before construction commences, during construction works and post-construction. Should contamination be identified which is considered to pose a risk to sensitive receptors then remediation will be undertaken.

11.10.15. Agricultural land north of the East Construction Laydown Area and within the Habitat Provision Area would be used for ecological mitigation and therefore it is considered likely to improve soil health as the land will no longer be exposed to agricultural practices detrimental to soil health. Removing land from agricultural use and creating an ecological mitigation area presents opportunities for improved soil health (improved soil structure, carbon sequestration, soil biodiversity) as the land will not be exposed to degradation from ploughing, pesticides and herbicides, compaction from farm vehicles etc.

11.10.16. Beyond this it is not considered that there are further opportunities for environmental enhancements in relation to ground conditions for the Proposed Scheme.

11.11. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

11.11.1. This section details the assessment of significant effects taking account of the secondary mitigation detailed in **Section 11.10** above.

CONSTRUCTION PHASE

Effects on Construction Workers from Potential Contamination within the Underlying Soils / Groundwater

11.11.2. The sensitivity of construction workers is **medium** and the magnitude of change, following mitigation, is **neutral**. Therefore, there is likely to be a direct, temporary, medium to long-term **neutral** effect (not significant) on construction workers following implementation of mitigation measures.

Effect to Controlled Waters / GWDTE

11.11.3. The sensitivity of controlled waters / GWDTE receptors is **high** and the magnitude of change, following mitigation, is **neutral**. Therefore, there is likely to be a direct, temporary, medium to long-term **neutral** effect (not significant) following the implementation of mitigation measures.

Effect on Agricultural Land

11.11.4. The sensitivity of agricultural land is **very high** and the magnitude of change, following mitigation, is **negligible adverse**. Therefore, there is likely to be a direct, temporary, medium to long-term **slight adverse** effect (not significant) following the implementation of mitigation measures.

11.12. CUMULATIVE EFFECTS

11.12.1. A detailed assessment of intra-project combined effects and inter-project cumulative effects for the Proposed Scheme has been carried out and is presented in **Chapter 18 (Cumulative Effects)** (document reference 6.1.18) of this ES.

11.13. IN-COMBINATION CLIMATE CHANGE IMPACTS

11.13.1. The in-combination Climate Change impact assessment considers the extent to which Climate Change may alter the effects which have already been identified within this Chapter. The assessment has been informed by professional judgement as there is inherent uncertainty in Climate Change projections.

11.13.2. The in-combination assessment of Climate Change impacts in relation to ground conditions is detailed in **Table 11.16** below.

Table 11.16 - Ground Conditions In-combination Climate Change Impacts

Climate hazard	Receptor	Likely impact(s)	Mitigation required
An increase in winter precipitation and a decrease in summer precipitation	Controlled Waters	Potential future increases or decreases in precipitation could affect groundwater (and consequentially surface water) quality underlying the Site as potential contaminants currently above the groundwater table could be mobilised.	A ground investigation to determine whether contaminants are present which present a risk to Controlled Waters. The investigation would also include monitoring of the groundwater table of up to a year to assess seasonal fluctuations in groundwater level.
Sea level rise	Controlled Waters	Potential future storm surges / high tides could affect groundwater and surface water quality underlying the Site as potential contaminants currently above the groundwater table could be mobilised.	As above.

11.14. MONITORING

11.14.1. Monitoring would be required during the construction phase for the implementation of the following:

a. Remediation Strategy;
b. Verification Report;
c. Earthworks Specification;
d. Materials Management Plan; and
e. Soil Handling Management Plan.

11.14.2. These mitigation measures (should they be required following completion of the ground investigation (with the exception of the Soil Handling Management Plan, which is secured via the CEMP)) would be secured by a requirement in the draft DCO submitted with the Application.

11.15. RESIDUAL EFFECTS

Table 11.17 below summarises the residual environmental effects associated with the Proposed Scheme.

Table 11.17 - Summary of Ground Conditions Residual Effects

Receptor	Potential Effects	Additional Mitigation	Residual Effects
Construction workers	Effects on construction workers from potential contamination within the underlying soils / groundwater during construction activities	~ Good practice measures to be implemented on site as detailed in **11.10.3** above including management of dust, hazardous materials and contaminated land ~ Intrusive Site Investigation ~ Remediation Strategy ~ Verification Report ~ MMP	**Neutral (Not Significant)** D / T / MT / LT
Controlled waters / GWDTE	Effect to Controlled waters / GWDTE during construction activities	~ Good practice measures to be implemented on site as detailed in **11.10.3** above including management of dust, hazardous materials and contaminated land ~ Intrusive Site Investigation ~ Remediation Strategy ~ Verification Report ~ MMP	**Neutral (Not Significant)** D / T / MT / LT
Agricultural land	Effect on agricultural land from construction activities	Soil Handling Management Plan to include instruction on stripping methods, stockpiling heights, reinstatement methods	**Slight adverse (Not Significant)** D / T / MT / LT

Key to table:

P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

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