



Humber Low Carbon Pipelines

Preliminary Environmental Information Report
Volume II Chapter 9 Geology and Hydrogeology
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nationalgrid

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9. Geology and Hydrogeology

9.1 Introduction

9.1.1 This Chapter reports the results of the preliminary assessment of the potential impacts and effects of the Project on Geology and Hydrogeology and describes:

- Relevant, legislation, policy and guidance;
- Engagement undertaken to date;
- The proposed assessment methodology and associated significance criteria;
- Preliminary baseline conditions;
- Potential impacts of construction, operation, and decommissioning;
- Potential design, mitigation, and enhancement measures;
- Summary of the preliminary assessment of potential significant effects; and
- Next steps.

9.1.2 This assessment considers the simultaneous construction of a dual pipeline system (one for carbon dioxide and one for hydrogen), as well as the associated Above Ground Installations (AGIs). The majority of the carbon dioxide pipeline will be up to 600 mm (24") nominal diameter and the hydrogen pipeline will be up to 900 mm (36") nominal diameter. This is referred to as the Base Case in this Preliminary Environmental Information Report (PEIR). Also under consideration is the possibility of deploying a larger carbon dioxide pipeline, with a diameter up to 750 mm (30") (with the hydrogen pipeline remaining the same diameter as within the Base Case). This is referred to in this PEIR as Sensitivity 1. Further details regarding the Base Case and Sensitivity 1, as well as the diameter and capacity of the pipelines are provided in Sections 2.3 and 2.4 of Chapter 2: Project Description. This chapter assesses the impacts and effects associated with the Base Case. It is anticipated that the types of potential impacts for the Base Case and Sensitivity 1 will be the same, although the magnitude of impacts may differ. A full assessment of Sensitivity 1 will be undertaken and recorded within the Environmental Statement (ES) if the larger carbon dioxide pipeline diameter is taken forward into the Development Consent Order (DCO) application.

9.1.3 This Chapter (and its associated figures and appendices) is intended to be read as part of the wider PEIR.

9.2 Legislation, policy and guidance

9.2.1 A summary of the international, national, and local legislation, planning policy and guidance relevant to the Geology and Hydrogeology assessment for the Project is set out below.

Legislation

The Environment Act, 2021 (2000/60/EC) (Ref 9.1)

- 9.2.2 The Environment Act allows the UK to enshrine some environmental protection into law. It offers new powers to set new binding targets, including for air quality, water, biodiversity, and waste reduction.
- 9.2.3 Whilst not directly implementing new powers relating to geology and hydrogeology, the act does give powers to the Secretary of State to amend or modify legislation that does.

European Union (Withdrawal) Act (Ref 9.2)

- 9.2.4 Under Section 2 of the European Union (Withdrawal) Act 2018, Regulations originating from the European Union continue to have effect in domestic law following the UK's withdrawal from the European Union.

The Water Environment (Water Framework Directive) Regulations 2017 SI 407 (Ref 9.3)

- 9.2.5 These regulations aim to prevent the deterioration of the water environment and improve water quality by managing water in natural river basin districts rather than by administrative boundaries.

The Environmental Permitting (England and Wales) Regulations 2016 SI 1154 (Ref 9.4)

- 9.2.6 The regulation aims to consolidate the existing environmental permitting system which integrates the regimes which cover waste management licensing, pollution prevention and control, landfill, waste incineration of large combustion plants, water discharge consents, groundwater authorisations and radioactive substances.

Classification Labelling & Packaging (CLP) Regulation (2008/1272/EC) (Ref 9.5), replacing The Dangerous Substances Directive (67/548/EEC) in 2016 (Ref 9.6)

- 9.2.7 The purpose of the CLP Regulation is to harmonise the criteria for classification of substances and mixtures, and the rules on labelling and packaging for hazardous substances and mixtures. It also aims at establishing a classification and labelling inventory of substances.

Environmental Damage (Prevention and Remediation) (England) Regulations, 2015 SI 810 (Ref 9.7)

- 9.2.8 These regulations impose obligations on operators of certain activities, requiring them to prevent or remediate environmental damage. This applies to damage to water, land, and sensitive land uses such as sites of special scientific interest, protected species and natural habitats.

Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (as amended) (Ref 9.8)

- 9.2.9 These regulations set the standards for the storage silage, slurries, and agricultural fuel oil with the aim of reducing and minimising the risk of water pollution. These substances have all been related to significant pollution incidents on farms where storage quality and capacity is often inadequate.

- 9.2.10 This relates to the Project by setting standards and controls for the use of fuel oils for heat and power in generators and plant on site and for the storage of fuel oil on site during construction phase.

The Priority Substances Directive (2008/105/EC) (Ref 9.9)

- 9.2.11 This Priority Substances Directive sets down environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of Directive 2000/60/EC, with the goal of achieving good surface water chemical status and in accordance with the provisions and objectives of Article 4 of that Directive.

The Groundwater Directive (2006/118/EC) (Ref 9.10)

- 9.2.12 This Directive establishes specific measures as provided for in Article 17(1) and (2) of Directive 2000/60/EC in order to prevent and control groundwater pollution. These measures include in particular:
- (a) criteria for the assessment of good groundwater chemical status; and
 - (b) criteria for the identification and reversal of significant and sustained upward trends and for the definition of starting points for trend reversals (Article 1, paragraph 1).
- 9.2.13 This Directive also complements the provisions preventing or limiting inputs of pollutants into groundwater already contained in Directive 2000/60/EC and aims to prevent the deterioration of the status of all bodies of groundwater (Article 1, paragraph 2).

The Contaminated Land (England) Regulations (CLR), 2006 SI 1380 (Ref 9.11)

- 9.2.14 The CLR list the requirements for the identification and remediation of contaminated land under Part 2A of the Environmental Protection Act 1990. It also details the characteristics for land to be designated as a special site.

The Water Act 2003 (Ref 9.12)

- 9.2.15 The Water Act aims to provide a modern, efficient and robust legislative framework to facilitate sustainable water resources management and economic growth through the new provisions it contains.

The Water Framework Directive (2000/60/EC) (Ref 9.13)

- 9.2.16 The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater.
- 9.2.17 This will be applied by assessing the impacts the Project may have on water bodies within the Proposed Order Limits and any linking water bodies.

The Environment Act, 1995 (Ref 9.14)

- 9.2.18 The aim of the Environment Act was to create a number of agencies (Environment Agency, Scottish Environmental Protection Agency (SEPA) etc.) with the aim of setting out new standards for environmental management to include but not limited to provisions for contaminated land, the control of pollution, national parks and conservation of the environment.

The Water Resources Act 1991 (as amended) (Ref 9.15)

- 9.2.19 The Water Resources Act regulates water quality and pollution, flood defence and water resources as well as providing the general structure for the management of water resources within England and Wales.

The Land Drainage Act 1991 (as amended) (Ref 9.16)

- 9.2.20 The Act lists the functions of boards and local authorities in relation to land drainage. It includes the relevant powers to ensure that riparian landowners take appropriate care and maintenance of ordinary water courses.

Environmental Protection Act, 1990 (Ref 9.17)

- 9.2.21 The Environmental Protection Act establishes the fundamental structure and authority for waste management and control of emissions into the environment for England, Wales and Scotland.

Policy

National Planning Policy Framework (NPPF) (2021) (Ref 9.18)

- 9.2.22 Paragraph 174 of the National Planning Policy Framework (NPPF) sets out policy in relation to protecting and enhancing sites of biodiversity or geological value equal to their statutory status. It includes policy on preventing new and existing development from contributing to being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution and land instability. It also details policy on remediating and mitigating despoiled, degraded and derelict land, where required.

Overarching National Policy Statement for Energy (EN-1) (2011) (Ref 9.19)

- 9.2.23 The overarching National Policy Statement (NPS) for Energy (EN-1) sets out policy highlighting the requirement to establish the existing status of the water environment, prior to the Project being undertaken to allow any potential effects on the water environment to be taken into consideration.
- 9.2.24 It recognises that development can have adverse effects on the water environment including groundwater. This includes during the construction, operational and decommissioning phases where demand can be placed on water supplies within the area and can lead to additional discharges of water. There may also be an increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health or on protected species and habitats (see Section 4.3 and Section 4.18) and could, in particular, result in surface waters, groundwaters or protected areas failing to meet environmental objectives established under the Water Framework Directive.

Draft Overarching National Policy Statement (NPS) for Energy (EN-1) (2021) (Ref 9.20)

- 9.2.25 The draft NPS for Energy (EN-1) highlights emerging policy. Key sections include Paragraph 5.16.4 where it details the consideration of protective measures to control the risk of groundwater pollution. The draft NPS also highlights the potential for particular activities relating to discharge that may be subject to pollution control.

National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (2011) (Ref 9.21)

- 9.2.26 The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) details policy on applications received for gas supply infrastructure and gas and oil pipelines which the Project falls under.
- 9.2.27 The statement highlights that when designing the route for pipelines, constraints relating to existing infrastructure should be taken into consideration. This is undertaken during the assessment of baseline conditions.
- 9.2.28 The statement also recommends that when choosing the route of the pipeline to avoid and minimise adverse effects from usage below the surface. An example would be to route the pipeline around particular areas of concern such as Source Protection Zones (SPZs) and landfill sites where possible to limit the effects.

Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (2021) (Ref 9.22)

- 9.2.29 Paragraph 2.9.34 highlights that new pipelines would be installed within a variety of geological conditions. Therefore, it is important for the Project that an in-depth review of available information regarding ground investigations has been undertaken along with appropriate ground investigation to determine the ground conditions the Project would encounter.
- 9.2.30 Paragraph 2.9.36 recognises that: *'In circumstances where an applicant proposes to use horizontal directional drilling (HDD) as the means of installing a pipeline under a National or European Site, the applicant should demonstrate that sufficient bore holes have been sunk in order to properly assess that the geological conditions are conducive to HDD. This is relevant as HDD is a method currently under consideration for the Project at certain locations. The applicant should provide an alternative means for installing the pipeline in the event that HDD fails. Such alternative means could include open cut, micro-tunnelling and tunnelling.'*
- 9.2.31 Paragraph 2.9.27 recognises that: *'Constructing pipelines creates corridors of surface clearance and excavation that can potentially affect watercourses, aquifers, water abstraction and discharge points and areas prone to flooding. Pipeline impacts could include inadequate or excessive drainage, different flow direction, flooding, disturbance to water ecology or pollution due to silt from construction. Impacts during construction should be avoided through route selection wherever possible or mitigated if unavoidable and ground reinstated after construction'*. Dewatering may be required as part of the construction, operational and decommissioning phases of the Project and therefore a hydrogeological assessment will need to be undertaken to address the potential effects.

North Lincolnshire Council Local Plan (2020) (Ref 9.23)

- 9.2.32 The North Lincolnshire Council Local Plan (NLCLP) is a framework which sets out planning policies for North Lincolnshire and identifies how land will be used.
- 9.2.33 Key policies covered within this plan that are relevant to the Project include:
- Policy RD1p: Supporting Sustainable Development in the Countryside;
 - Policy SS1p: Presumption in Favour of Sustainable Development;
 - Policy SS2p: A Spatial Strategy for North Lincolnshire;

- Policy SS3p: Development Principles;
- MIN1p: Mineral Supply Requirements;
- MIN3p: Mineral Extraction;
- WAS1p: Waste Management Principles;
- ID1p: Delivering Infrastructure;
- DQE3p: Biodiversity and Geodiversity; and
- DQE8p: Climate Change and Low Carbon Living.

East Riding of Yorkshire Council Local Plan (2016) (Ref 9.24)

9.2.34 The East Riding Yorkshire Council Local Plan (ERYCLP) is a set of planning documents that pull together to provide the long-term development plan for East Riding. It is a long-term strategy that will help guide new development across East Riding.

9.2.35 Key policies covered within this plan that are relevant to the Project include:

- Policy S1: Presumption in favour of sustainable development;
- Policy S2: Addressing climate change;
- Policy S3: Focusing development;
- Policy S4: Supporting development in Villages and the Countryside;
- Policy EC5: Supporting the energy sector;
- Policy EC6: Protecting mineral resources;
- Policy ENV1: Integrating high quality design;
- Policy ENV4: Conserving and enhancing biodiversity and geodiversity;
- Policy ENV6: Managing environmental hazards; and
- Policy C1: Providing infrastructure and facilities.

Selby District Council Local Plan (2005) (Ref 9.25)

9.2.36 The Selby District Local Plan (SDCLP) is a framework for promoting, co-ordinating and controlling future development within the Selby area. It develops and underpins many of the aims and objectives of the council.

9.2.37 Key policies covered within this plan that are relevant to the Project include:

- Policy SP17: Low Carbon and Renewable Energy;
- Policy SP18: Protecting and Enhancing the Environment; and
- Policy SP19: Design Quality.

Central Lincolnshire Council Plan (CLCP) (2017) (Ref 9.26)

9.2.38 The CLCP includes the City of Lincoln Council, North Kesteven Council and West Lindsey District Council. The plan prepares plans and policies which help create places that are sustainable and attractive to live in within the area.

9.2.39 Key policies covered within this plan that are relevant to the Project include:

- Policy LP1: A Presumption in Favour of Sustainable Development 7;
- Policy LP14: Managing Water Resources and Flood Risk 45;
- Policy LP15: Community Facilities 47;
- Policy LP16: Development on Land Affected by Contamination 48;
- Policy LP18: Climate Change and Low Carbon Living 51;
- Policy LP19: Renewable Energy Proposals 52;
- Policy LP20: Green Infrastructure Network 54;
- Policy LP21: Biodiversity and Geodiversity 55; and
- Policy LP55: Development in the Countryside 125.

Guidance

Environment Agency (2020) Land Contamination Risk Management (LCRM) (Ref 9.27)

9.2.40 This guidance document provides information on how to assess and manage the risks from land contamination.

Highways England (2020) Design Manual for Roads and Bridges (DMRB), LA 113 Road drainage and the Water Environment (Ref 9.28)

9.2.41 This document describes the requirements for assessment and management of the impacts that road projects can have on the water environment. There is an absence of specific guidance in relation to carbon transportation schemes for assessing Geology and Hydrogeology, therefore, DMRB has been used as it is considered to be the most appropriate methodology for the Project because it is designed for assessing effects on linear schemes (including 'point' features), albeit road schemes, and is familiar with statutory consultees.

Highways England (2019) Design Manual for Roads and Bridges (DMRB), LA 109: Geology and Soils (Ref 9.29)

9.2.42 This document sets out the requirements for assessing and reporting the effects of highway projects on geology and soils. There is an absence of specific guidance in relation to pipeline schemes for assessing Geology and Hydrogeology, therefore, DMRB has been used as it is considered to be the most appropriate methodology for the Project because it is designed for assessing effects on linear schemes (including 'point' features), albeit road schemes, and is familiar with statutory consultees

Planning Practice Guidance for the Natural Environment (PPGNE) 2019 (Ref 9.30)

9.2.43 The Technical Guidance explains the need for planning decisions to take into account the value of soils and agricultural land to enable informed choices on the future use of soil resources and agricultural land within the planning system. (Paragraphs 001 and 002).

Environment Agency (2012) Pollution Prevention Guidance PPG6: Working at Construction and Demolition Sites (Ref 9.31)

9.2.44 This guidance document provides advice and guidance to help prevent pollution on construction and demolition sites.

Environment Agency (2007) Pollution Prevention Guidance PPG13 Vehicle Washing and Cleaning (Ref 9.32)

9.2.45 This guidance document provides pollution prevention guidelines for vehicle washing and cleaning good practice.

Natural England (2012) Technical Information Note 049 (TIN049): Agricultural Land Classification: Protecting the Best and Most Versatile agricultural land (Ref 9.33)

9.2.46 The Technical Guidance explains the UK Government Policy to protect agricultural land and the Agricultural Land Classification (ALC) system and uses.

Department for the Environment, Food and Rural Affairs (DEFRA): Construction Code of Practice for the Sustainable Use of Soil on Development Site (2009) (Ref 9.34)

9.2.47 The Technical Guidance provides relevant advice on the use of soil within construction projects.

Ministry of Agriculture, Fisheries and Food (MAFF) Agricultural Land Classification of England and Wales Revised guidelines and criteria for grading the quality of agricultural land (1988) (Ref 9.35)

9.2.48 The Technical Guidance from MAFF provides revised guidelines and criteria for grading the quality of agricultural land.

9.3 Consultation and engagement

9.3.1 A summary of the Environmental Impact Assessment (EIA) Scoping Opinion from the Planning Inspectorate (PINS) and responses to this EIA Scoping Opinion are outlined below. Furthermore, all relevant engagement undertaken to date is outlined in this Section.

Response to the EIA Scoping Opinion

9.3.2 An EIA Scoping Opinion (Appendix 1.2: EIA Scoping Opinion (Volume III)) was received by the Applicant from PINS on 20 May 2022. Table 9.1 lists the comments that PINS and consultation bodies made in relation to Geology and Hydrogeology and shows how the Applicant is responding to these.

9.3.3 At this stage of the assessment, nothing has been scoped out of this chapter of the PEIR.

Table 9.1: Summary of EIA Scoping Opinion in relation to Geology and Hydrogeology

Section reference	Applicant's proposed matter	Stakeholder/statutory consultee comments	Response
3.5.2	Guidance	<p><i>The Inspectorate advises that the Environment Agency's Land Contamination Technical Guidance and approach to groundwater protection should be followed when considering potential land or groundwater contamination effects. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i></p>	<p>The recommended guidance has been followed as part of this preliminary assessment and will be followed for the ES.</p>
3.5.3	Scope of assessment – bedrock geologies	<p><i>The Applicant has provided a list of bedrock geologies within the Scoping Report, however the list provided is not exhaustive and several important bedrock aquifers have not been identified, including Kirton Cementstone Beds, Scawby Limestone, Hibaldstow Limestone, Raventhorpe Beds, Santon Oolite, all of which comprise the Lincolnshire Limestone aquifer. In addition, Blisworth Limestone is a principal aquifer and Cornbrash Formation is a Secondary A aquifer; both of these are crossed by the pipeline route. These need to be included within future assessment work. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i></p>	<p>The relevant bedrock geologies and aquifers have been updated in line with comments and included within the scope of the preliminary assessment and will be included within the ES.</p>
3.5.4	Scope of assessment –	<p><i>Blisworth Limestone Rutland Formation (ID GB40401G444500) and Cornbrash (ID</i></p>	<p>Additional Water Framework Directive groundwater bodies updated to include</p>

Section reference	Applicant's proposed matter	Stakeholder/statutory consultee comments	Response
	Water Framework Directive (WFD) groundwater bodies	<i>GB40402G444700) are missing from the list of WFD groundwater bodies and should be included within future assessment work. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i>	Blisworth Limestone Rutland Formation and Cornbrash in the scope of preliminary assessment.
3.5.5	Scope of assessment – deregulated water supplies	<i>The Applicant is advised that deregulated supplies still in use are potential receptors which need to be considered within future assessment work. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i>	Receptors updated to include deregulated supplies in the scope of the preliminary assessment
3.5.6	Scope of assessment – groundwater resource losses	<i>The Inspectorate advises that the potential for groundwater resource losses, should artesian flow be encountered during construction excavations, should be included within future assessment work. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i>	Potential for groundwater resource losses due to artesian flow added to the scope of preliminary assessment.
8.2.2	Environment Agency Response	<i>We recommend that The Environment Agency's approach to groundwater protection (The Environment Agency's approach to groundwater protection (publishing.service.gov.uk)) should be referenced as valuable guidance for this chapter.</i>	Recommend guidance is included within the preliminary assessment.

Section reference	Applicant's proposed matter	Stakeholder/statutory consultee comments	Response
8.5.1. and 8.6.6		<p><i>The list of bedrock geologies provided is not exhaustive and a number of important bedrock aquifers have not been identified within this section, including Kirton Cementstone Beds, Scawby Limestone, Hibaldstow Limestone, Raventhorpe Beds, Santon Oolite, all of which comprise the Lincolnshire Limestone aquifer. In addition, Blisworth Limestone is a principal aquifer and Cornbrash Formation is a Secondary A aquifer; both of these are crossed by the pipeline route. These need to be included in all assessments. These geological units are evident in the Scoping Report Vol II, Part 3, Fig 8.2 pages 7 and 8.</i></p>	<p>Updated and included within this preliminary assessment.</p>
8.6.16		<p><i>Similarly, this section does not identify all WFD groundwater bodies: Blisworth Limestone Rutland Formation (ID GB40401G444500) and Cornbrash (ID GB40402G444700) are missing.</i></p>	<p>Updated and included within this preliminary assessment.</p>
8.6.17-18		<p><i>Deregulated supplies still in use should also be included. These are potential receptors which need to be considered. Local authorities should hold records of all unlicensed private water supplies in their districts and should be contacted for this information.</i></p>	<p>Local authorities have been contacted for records and receptors identified included in this preliminary assessment.</p>
8.6.21		<p><i>We note that recorded current and historic landfills identified through correspondence with the relevant local authorities have been</i></p>	<p>A figure regarding landfills has been submitted as part of this preliminary assessment.</p>

Section reference	Applicant's proposed matter	Stakeholder/statutory consultee comments	Response
		<p><i>collated. We have not had the opportunity to confirm the figures given at this point.</i></p>	
8.7.3 – 8.7.4		<p><i>We recommend that our Land Contamination Technical Guidance (Land contamination: technical guidance - GOV.UK (www.gov.uk)) should be followed when considering potential land or groundwater contamination. We recommend that developers should:</i></p> <ul style="list-style-type: none"> <i>• Follow the risk management framework provided in 'Land contamination: risk management' when dealing with land affected by contamination</i> <i>• Refer to our Guiding principles for land contamination for the type of information that we require in order to assess risks to controlled waters from the site – the local authority can advise on risk to other receptors, such as human health</i> <i>• Consider using the National Quality Mark Scheme for Land Contamination Management which involves the use of competent persons to ensure that land contamination risks are appropriately managed</i> <i>• Refer to the contaminated land pages on gov.uk for more information.</i> <p><i>If, during construction, contamination not previously identified is found to be present along the route then works should cease (unless otherwise agreed in writing with the local planning authority) until the developer has submitted a remediation strategy to the local planning authority (in consultation with the Environment Agency) detailing how this</i></p>	<p>Recommended guidance included within the preliminary assessment.</p>

Section reference	Applicant's proposed matter	Stakeholder/statutory consultee comments	Response
		<i>unsuspected contamination will be dealt with and obtained written approval from the local planning authority.</i>	
8.7.5		<i>We welcome the proposal for detailed hydrogeological assessment for trenchless techniques and dewatering activities and ask to be consulted on these assessments. There is no mention of dewatering being a licensable activity here, although our earlier advice has been noted in Table 8.1. Unless any dewatering activities meet the criteria of the Water Abstraction and Impounding (Exemptions) Regulations 2017, an abstraction licence will be required. The development programme needs to account for potentially lengthy permitting timescales.</i>	Noted, we will consult the Environment Agency regarding the detailed hydrogeological assessment.
8.8.2		<i>This section does not include the potential for groundwater resource losses should artesian flow be encountered during construction excavations; this should be included.</i>	Included as part of this preliminary assessment.
8.8.3		<i>It would be useful to understand what potential need there may be for dewatering to take place during operation of the scheme.</i>	Included within the assessment. Dewatering may be required for maintenance works during the operational phase if repair works are required to the pipeline due to either shallow groundwater or artesian conditions.

Engagement undertaken to date

9.3.4 Table 9.2 provides a summary of the engagement undertaken to inform the assessment to date.

Table 9.2: Summary of engagement undertaken

Consultee	Date and method of engagement	Summary of engagement	Response
Environment Agency	14 July 2022 (virtual meeting)	A meeting with regional representatives to discuss current progress of PEIR and EIA Scoping Report response.	Environment Agency comments from EIA Scoping Report have been addressed within this PEIR assessment. Confirmed assessment methodology.
East Riding of Yorkshire Council	01 December 2021 (email correspondence)	Letter was shared outlining the proposed approach to this topic, including details of what was proposed to be scoped in and out.	Stated assessment methodology approach for the EIA in relation to Geology and Hydrogeology was acceptable and no comments to make (received from East Riding of Yorkshire Council on 4 February 2022). The proposed assessment approach has been used for this PEIR.
North Lincolnshire Council	01 December 2021 (Email correspondence)	Letter was shared outlining the proposed approach to this topic, including details of what was proposed to be scoped in and out.	Stated no objections to proposal in principle (received 1 December 2021) The proposed assessment approach has been used for this PEIR.
West Lindsey District Council	15 November 2021 (email correspondence)	Letter was shared outlining the proposed approach to this topic, including details of what was proposed to be scoped in and out.	Stated assessment methodology approach for the EIA in relation to Geology and Hydrogeology was acceptable and no comments to make (received 9 February 2022). The proposed assessment approach has been used for this PEIR.

Consultee	Date and method of engagement	Summary of engagement	Response
Environment Agency	11 November 2021 (email correspondence)	Letter was shared outlining the proposed approach to this topic, including details of what was proposed to be scoped in and out.	<p>Stated they are comfortable with the methodology but to ensure to assess the need for abstraction licence if dewatering is required and that they are applied for in plenty of time (received 1 December 2021). The proposed assessment approach has been used for this PEIR.</p> <p>The need for an abstraction licence will be assessed as more detailed design progresses and, if found to be required, applied for in plenty of time (Response received 1 December 2021).</p>
Selby District Council	11 November 2021 (Email correspondence)	Letter was shared outlining the proposed approach to this topic, including details of what was proposed to be scoped in and out.	The proposed assessment approach has been used for this PEIR (Response received 4 February 2022).

9.4 Assessment methodology and significance criteria

Study Area

- 9.4.1 The Study Area for the assessment of the Geology and Hydrogeology for the Project is 250 m either side of the Proposed Order Limits as agreed with stakeholders. Interaction between the Project and receptors, or sources, of contamination beyond 250 m generally would not occur as a result of the ground conditions present in and around the Project.
- 9.4.2 The majority of receptors, and sources of contamination, have been identified within the Study Area. Where relevant for specific subtopics, such as groundwater Source Protection Zones, the Study Area extends to 1 km either side of the Proposed Order Limits data collection. This is noted in the applicable section.

Desk study

- 9.4.3 Baseline conditions of the Project were established during a desk study using the following sources:
- Google Maps (Ref 9.36);
 - Groundsure Report (Ref 9.37);
 - MAGIC.gov.uk (DEFRA) (Ref 9.38);
 - British Geology Survey (BGS) Online Viewer (Geo-Index) (Ref 9.39);
 - Zetica Report Humberside - UXO Desk Study & Constraints Assessment (Ref 9.40);
 - The Coal Authority (Ref 9.41);
 - UKradon (UK Health Security Agency) (Ref 9.42); and
 - Project's Aerial Imagery (Ref 9.43).

Site visits and surveys

- 9.4.4 Site walkovers were undertaken within the Proposed Order Limits between 21 July and 25 July 2022. Photographs, details of locations visited and observations can be found in Appendix 9.1 (Volume III).

Impact assessment methodology

- 9.4.5 Utilising the baseline information collected and in engagement with statutory consultees, a combination of qualitative and quantitative risk assessment have been undertaken to assess the potential impacts and effects of the existing ground conditions on the Project, and the potential impacts and effects of the Project on the Geology and Hydrogeology.
- 9.4.6 In relation to ground contamination, the risk assessment has been based on the source-pathway-receptor methodology outlined in Land Contamination Risk Management (LCRM) (Ref 9.27) and promoted by DEFRA and the Environment Agency. For there to be an identifiable risk, not only must there be contaminants present (source) there must also be a receptor and a viable pathway which allows the source to impact on the receptor.

9.4.7 The overall assessment methodology is summarised in Chapter 4: EIA Methodology (Volume II). However, the assessment of the significance of the potential effects on Geology and Hydrogeology will be based on a combination of the guidance in the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (geology) (Ref 9.29) and LA 113 Road Drainage and the Water Environment (groundwater) (Ref 9.28). The criteria used to determine the sensitivity of receptors in the context of DMRB assessment are presented below in Table 9.3.

Table 9.3: Criteria to determine the sensitivity of receptors

Sensitivity / Value	Description / Criteria	Typical Examples
High	<p><u>Geology</u> Very rare and of international importance with no potential for replacement.</p> <p><u>Hydrogeology</u> Nationally significant attribute of high importance.</p>	<p><u>Geology</u> UNESCO World Heritage Sites; Sites of Special Scientific Interest (SSSIs) of international importance; or Global Geoparks.</p> <p><u>Contamination</u> Very high sensitivity land use (e.g., residential).</p> <p><u>Hydrogeology</u> Principal aquifer providing a regionally important resource and/ or supporting site protected under European and UK habitat legislation; Source Protection Zone 1; or Groundwater supports Groundwater Dependent Terrestrial Ecosystem (GWDTE).</p>
Medium	<p><u>Geology</u> Rare and of national importance with little potential for replacement.</p> <p><u>Hydrogeology</u> Locally significant attribute of high importance.</p>	<p><u>Geology</u> SSSIs; or National Nature Reserves.</p> <p><u>Contamination</u> High sensitivity land use (e.g., public open space).</p> <p><u>Hydrogeology</u> Principal aquifer providing a locally important resource or supporting a river ecosystem; Source Protection Zone 2; or Groundwater supports Groundwater Dependent Terrestrial Ecosystem (GWDTE).</p>

Sensitivity / Value	Description / Criteria	Typical Examples
Low	<p><u>Geology</u> Of regional importance with limited potential for replacement.</p> <p><u>Hydrogeology</u> Of moderate quality and rarity.</p>	<p><u>Geology</u> Regionally Important Geological Sites (RIGS).</p> <p><u>Contamination</u> Medium sensitivity land use (e.g., commercial).</p> <p><u>Hydrogeology</u> Aquifer providing water for agricultural or industrial use with limited connection to surface water; or Source Protection Zone 3.</p>
Negligible	<p><u>Geology</u> Of local importance / interest with potential for replacement or little/ no local interest.</p> <p><u>Hydrogeology</u> Lower quality.</p>	<p><u>Geology</u> Non-designated geological exposures, former quarries / mining sites. No geological exposures.</p> <p><u>Contamination</u> Low sensitivity land use (e.g., highways and rail); or No sensitive land use proposed.</p> <p><u>Hydrogeology</u> Unproductive strata.</p>

Magnitude

9.4.8 The magnitude of an impact considers the scale of the predicted change to the baseline condition taking into account its duration (i.e., the magnitude may be moderated by the impacts being temporary rather than permanent, short term rather than long term). Definitions for impact magnitude are described in Table 9.4. It is unlikely that any effects on geology and soils would be beneficial, so the examples of magnitude all relate to adverse effects.

Table 9.4: Criteria to determine the magnitude of impact

Magnitude	Criteria	Typical Examples
High	<p><u>Geology</u> Loss of feature/ designation and/or quality and integrity, severe damage to key characteristics.</p> <p><u>Hydrogeology</u> Loss of attribute and/or quality and integrity of the attribute.</p>	<p><u>Geology</u> Destruction of features at a protected site; i.e., SSSIs of international importance; or Global Geoparks.</p> <p><u>Contamination</u> Significant contamination identified; Contaminant concentrations significantly exceed background levels and relevant screening criteria; Potential for significant harm to human health; or Contamination heavily restricts future use of land.</p> <p><u>Hydrogeology</u> Loss of, or extensive change to, an aquifer; Loss of regionally important water supply; Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies; and Reduction in water body WFD classification; or Loss or significant damage to major structures through subsidence or similar effects.</p>
Medium	<p><u>Geology</u> Partial loss of feature/designation, potentially adversely affecting integrity; partial loss of/damage to key characteristics, features or elements.</p> <p><u>Hydrogeology</u> Results in effect on integrity of attribute, or loss of part of attribute.</p>	<p><u>Geology</u> Partial loss of features at a protected site; i.e., SSSIs; National Nature Reserves.</p> <p><u>Contamination</u> Contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria; and Significant contamination can be present; or Control/remediation measures are required to reduce risks to human health/make land suitable for intended use.</p> <p><u>Hydrogeology</u> Partial loss or change to an aquifer; Degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies; Partial loss of the integrity of GWDTE; Contribution to reduction in water body WFD classification; or Damage to major structures through subsidence or similar effects or loss of minor structures.</p>
Low	<u>Geology</u>	<u>Geology</u>

Magnitude	Criteria	Typical Examples
	<p>Minor measurable change in geological feature/designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.</p> <p><u>Hydrogeology</u> Results in some measurable change in attributes, quality or vulnerability.</p>	<p>Minor measurable change of features at Geological sites; i.e., RIGS</p> <p><u>Contamination</u> Contaminant concentrations are below relevant screening criteria; Significant contamination is unlikely with a low risk to human health; or Best practice measures can be required to minimise risks to human health.</p> <p><u>Hydrogeology</u> Minor effects on an aquifer, GWDTEs, abstractions and structures.</p>
Negligible	<p><u>Geology</u> Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature/designation. Overall integrity of resource not affected.</p> <p><u>Hydrogeology</u> Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.</p>	<p><u>Geology</u> Very minor change of features at sites of local importance, i.e., non-designated geological sites.</p> <p><u>Contamination</u> Contaminant concentrations substantially below relevant screening criteria; or No requirements for control measures to reduce risks to human health/make land suitable for intended use.</p> <p><u>Hydrogeology</u> No measurable impact upon an aquifer and/or groundwater receptors.</p>

Significance criteria

9.4.9 The significance of environmental effect is typically a function of the sensitivity of a receptor and the magnitude of an impact. A matrix for the determination of significance is provided in Table 4.1 in Chapter 4: EIA Methodology (Volume II).

Assumptions and limitations

9.4.10 To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- The assessment will rely on available data, and reasonable endeavours will be made to ensure that the data is accurate and up to date, however the accuracy of third-party information cannot be confirmed.
- Assessments are limited by availability of design information, specifically in relation to below ground structures (i.e., depth of piles/foundations, pipe/tunnel invert levels).
- No ground investigation for the project has been undertaken to date. It is assumed a preliminary ground investigation will be undertaken to inform the design in 2023. In

addition, it is then assumed that further ground investigation would be undertaken to inform detailed design.

9.5 Baseline conditions

Existing baseline

- 9.5.1 This section reports the baseline conditions relating to geology and hydrogeology for the Project. It includes information on geology, hydrogeology, areas of potential contaminated land based on current and historical land use, waste, ground gases, previous ground investigations and information from statutory bodies including Environment Agency, East Riding of Yorkshire Council, North Lincolnshire Council, Selby District Council and West Lindsey District Council.

Proposed Order Limits

- 9.5.2 To aid reporting, for this section of the baseline conditions, the information gathered refers to the Proposed Order Limits and Study Area as a whole.
- 9.5.3 This section signposts topics that related to geology and hydrogeology but are reported on in the PEIR in different chapter

Soils

- 9.5.4 The effects of the Project on the agricultural quality of soils are considered in Chapter 5: Agriculture & Soils (Volume II).

Hydrology

- 9.5.5 The effects of the Project on surface water features are considered in Chapter 17: Hydrology and Land Drainage Risk (Volume II).

Waste and Materials

- 9.5.6 The effects of the Project on waste and materials are considered in Chapter 16: Waste and Materials (Volume II). Where there is overlap with this chapter to the geology and hydrogeology, we have detailed historic and current landfills as well as mineral safeguarding zones within the Study Area.

Ground Gas

- 9.5.7 Ground gas, including methane and carbon dioxide, associated with the natural strata and Made Ground deposits, may be present. Ground gas may also be associated with identified current and historical landfills, as well as unregistered infilled land (e.g., backfilled sand and chalk pits) within the Study Area.

Unexploded Ordnance (UXO) Potential

- 9.5.8 A UXO Desk Study & Constraints Assessment has been undertaken by Zetica for National Grid (Ref 9.40). It concludes that the majority of the route is low risk however there may be localised areas of moderate and high risk especially within the boundaries of former military establishments such as airfields and defensive installations.

Previous Ground Investigation

- 9.5.9 BGS Geo-Index online (Ref 9.39) resources record ground investigation data from many boreholes within the Study Area. The strata encountered in these exploratory locations

generally correlate with information obtained from BGS mapping data. A list of all BGS boreholes within the Study Area is shown in Appendix 9.2 (Volume III). No contemporary ground investigation data has been provided at this time.

Section 1 – Drax to Keadby

Geology

- 9.5.10 Published geological maps and the Geographic Information System (GIS) data sourced from the BGS indicates the Study Area is underlain by the geological succession summarised below in Table 9.5. Geological mapping of the Section 1 of the Study Area can be found on Figures 9.1 and 9.2 (Volume IV).

Table 9.5: Summary of Geology for Section 1 – Drax to Keadby

Stratum Type	Description
1:63,360 Scale BGS Map Sheet 86 and 1:50,000 Scale BGS Map Sheet 80	
Made Ground	The BGS indicates no areas of 'artificial ground' located within this section of the Proposed Order Limits.
Superficial	A review of publicly available information from the BGS online interactive map indicates that the Proposed Order Limits within this section travels over six different Superficial deposits. This includes the Brighton Sand Formation comprising of slightly clayey sand to silty sand with a variably developed very dusky red to black compressible peat to clayey sandy peat base, Warp – clay and silt, Lacustrine Beach Deposits – sand and gravel, Hemingbrough Glaciolacustrine Formation, Sutton Sand Formation - sand and Alluvium – clay, silt, sand and gravel.
Bedrock	The bedrock geology underlying this section of the Proposed Order Limits is Sherwood Sandstone Group – Sandstone comprising red, yellow and brown, part pebbly; conglomeratic in lower part; pebbles generally extraformational quartz and quartzite, with some intraformational clasts; subordinate red mudstone and siltstone and Mercia Mudstone Group – Mudstone and Siltstone and Dolomitic.

Geological Sites of Special Scientific Interest and Regionally Important Geological Sites

- 9.5.11 A review of currently available information has indicated that there are no Geological SSSIs or RIGS within the Study Area.

Hydrogeology

- 9.5.12 Mapping derived from the Groundsure Report Data (Ref 9.37) indicates that the hydrogeology within the Section 1 of the Study Area can be summarised as shown in Table 9.6. The spatial variation of the hydrogeology for this section is shown in Figures 9.3 and 9.4 (Volume IV).

Table 9.6: Summary of Hydrogeology for Section 1 – Drax to Keadby

Geology	Stratum	Aquifer Class
Superficial Deposits	Warp – Clay, Silt and Sand	Secondary A Aquifer
	Alluvium - Clay, Silt, Sand and Gravel	Secondary A Aquifer
	Brighton Sand Formation - Sand	Secondary A Aquifer
	Sutton Sand Formation - sand	Secondary A Aquifer
	Lacustrine Beach Deposits – Sand and Gravel	Secondary A Aquifer
	Hemingbrough Glaciolacustrine Formation	Unproductive Aquifer
Bedrock	Sherwood Sandstone Group – Sandstone	Principal Aquifer
	Mercia Mudstone Group – Mudstone	Secondary B Aquifer

9.5.13 The following WFD groundwater bodies have been identified within the Study Area of this section of the Proposed Order Limits (Ref 9.37 and Ref 9.38):

- Wharfe & Lower Ouse Sherwood Sandstone;
- Aire & Don Sherwood Sandstone;
- Idle Torne - Secondary Mudrocks; and
- Lower Trent Erewash - Secondary Combined.

9.5.14 The following SPZ have been identified within the Study Area of this section of the Proposed Order Limits:

- Zone 3 Total Catchment SPZ surrounding Drax.

9.5.15 The following Nitrate Vulnerable Zones (NVZ) have been identified within the Study Area of this section of the Proposed Order Limits:

- Aire from River Calder to River Ouse NVZ – Surface Water;
- Lower Don NVZ – Surface Water;
- Swinefleet Warping Drain Source to River Ouse NVZ – Surface Water;
- Paupers Drain Catchment (trib of Trent) NVZ – Surface Water; and
- North Soak Drain (trib of R Torne / Three Rivers) NVZ – Surface Water.

Information from Statutory Authorities

9.5.16 Details determined to be relevant to this section of the Study Area are summarised below. Further information and details are tabulated in Appendix 9.2 (Volume III) and Figure 9.5 (Volume IV).

Discharge consents

9.5.17 There are 32 discharge consents within the Section 1 of the Study Area. These relate to sewage discharges of final/treated effluent or to unspecified trade discharges.

Dangerous Substances Consents

- 9.5.18 Four active consents within the Section 1 of the Study Area, this includes a permit to discharge Arsenic into the River Don and another for Chromium, Copper, Lead, Nickel and Zinc into an unknown receiving water body. The remaining two active consents relate to Drax Power Station permitting the discharge of Arsenic, Chromium, Copper, Iron, Lead, Nickel, Vanadium, Zinc and Dichlorvos containing effluent and site drainage into the River Ouse have been identified.

National Incidents and Records of Pollution

- 9.5.19 Eight records exist within the Section 1 of the Study Area, all of which were classified as minor impact incidents. They include pollution of unidentified oils, organic oils, atmospheric pollutants, solvents, contaminated water to water, biodegradable waste to land and smoke to air.

Licensed Pollutant Release

- 9.5.20 One active permit has been identified within the Section 1 of the Study Area for Licensed Pollutant Release which refers to quarry processes at Drax Power Station.

Pollution Inventory Substance

- 9.5.21 There is one entry for Pollution Inventory Substances within the Section 1 of the Study Area of this section of the Proposed Order Limits. This entry relates to Croda Europe Limited; the activity involves organic chemicals and surface-active agents.

Hazardous Substance Storage

- 9.5.22 There is one entry within the Section 1 of the Study Area for the storage and use of substances at the White Rose Carbon Capture Project.

Control of Major Accident Hazard (COMAH) Sites

- 9.5.23 There is one active Control of Major Accident Hazard (COMAH) site within the Section 1 of the Study Area, this relates to Drax Power Limited.

Information from Local Authorities

Current and Historic Potentially Contaminative Land Uses

- 9.5.24 According to Selby District Council a number of potentially contaminative sites have been identified within the Proposed Order Limits. These include power stations, dismantled railway, haulage, agricultural land, sewage works, tanks and landfill sites.

Coal Mining and Shallowing Mining

- 9.5.25 Currently available records and mapping from the Coal Authority (Ref 9.41) indicate that there is a large segment of Section 1 of the Study Area that is classified as a Coal Mining Reporting Area from Drax to just north of Keadby (i.e. there is potential for coal mining activity).

Historic Potentially Contaminative Land Uses

- 9.5.26 A review of the data currently available through historical mapping and the Groundsure Report indicates that this section of the Project experienced numerous localised potentially contaminative historical land uses within the Proposed Order Limits and the wider Study Area. This included power stations, tanks, water and gas works, tar and resin distillery, depots, refuse heaps, abandoned railways, railways sidings, railway stations and sludge beds. Further details can be found in Appendix 9.2 (Volume III) and locations are shown on Figure 9.6 (Volume IV).

Current Potentially Contaminative Land Uses

- 9.5.27 A review of the current potentially contaminative land uses within the Section 1 of the Study Area suggests that the contaminative land uses are generally likely to be confined to agriculture.
- 9.5.28 Other current potentially contaminative land uses have been identified and are shown on Figure 9.7 (Volume IV) with details included in Appendix 9.2 (Volume III). These include the following:
- Haulage and Vehicle Servicing;
 - Water Pumping Stations and Outfalls;
 - Railway Tracks; and
 - Power Stations.

Waste

- 9.5.29 Recorded current and historic landfills and waste transfer sites identified within the Section 1 of the Study Area summarised below in Table 9.7. The location of the landfills and waste transfer sites are shown in Figure 9.8 (Volume IV) and further details can be found in Appendix 9.2 (Volume III).

Table 9.7: Summary of Waste for Section 1 – Drax to Keadby

Landfill Type	Details
Environment Agency Historic Landfill	5 No. Historical Landfills (Inert, Industrial, Household, Commercial) including 1 No. landfill within the Proposed Order Limits at Keadby Power Station.
Active or Recent Landfill	1 No. Active/Recent Landfill (Unspecified). 1 No. Possible Refuse Tip.
Waste Facility	2 No. Material Recycling Treatment Facility.
Waste Exemptions	8 No. Storage Waste Exemptions for Sludge.
Environment Agency Permitted Waste Sites Authorised Landfill	None identified within the section of the Proposed Order Limits.

Radon

- 9.5.30 Published radon data from UK Health and Security Agency (Ref 9.42) indicates that the Section 1 of the Study Area has a maximum radon potential of 1%.

Mineral Sites and Designations

- 9.5.31 According to publicly available information and the Groundsure data (Ref 9.37), the Proposed Order Limits are located within 500 m of the area subject to the following mineral safeguarding policies:
- North Yorkshire County Council (including Selby District Council) - North Yorkshire Minerals and Waste Joint Plan (Ref: 9.44)
 - Policy S01: Safeguarded surface mineral resources;

- Policy S02: Developments proposed within Surface Minerals Resource Areas;
- Policy S06: Minerals ancillary infrastructure safeguarding; and
- Policy S07: Consideration of applications in Consultation Areas.

9.5.32 Mineral Safeguarding Areas within the Proposed Order Limits include:

- ‘Sand and Gravel Superficial 250 m Buffer’.

Section 2 – Keadby to Scunthorpe

Geology

9.5.33 Published geological maps and the GIS data sourced from the BGS indicates the Section 2 of the Study Area is underlain by the geological succession summarised below in Table 9.8. Geological mapping of the Study Area can be found on Figures 9.1 to 9.2 (Volume IV).

Table 9.8: Summary of Geology for Section 2 – Keadby to Scunthorpe

Stratum Type	Description
1:63,360 Scale BGS Map Sheet 86 and 1:50,000 Scale BGS Map Sheet 80	
Made Ground	The BGS indicates no areas of ‘artificial ground’ located within this section of the Proposed Order Limits.
Superficial	This section of the Proposed Order Limits is underlain by a mixture of Sutton Sand Formation comprising Fine-grained silty sand, Alluvium – clay, silt, sand and gravel, Glaciofluvial Deposits, Devensian – sand and gravel, Peat, Head and Warp – clay and silt deposits.
Bedrock	The majority of the bedrock underlying this section of the Proposed Order Limits is the Mercia Mudstone Group, with a small section just south of Scunthorpe being underlain by the Scunthorpe Mudstone Formation – Limestone. Frodingham Ironstone Member – Ironstone, Kirton Cementstone Beds – Limestone, Raventhorpe Beds - Limestone And Argillaceous Rocks, Interbedded, Pecten Ironstone (Bed) – Ironstone, Marlstone Rock Formation - Ferruginous Limestone And Ferruginous Sandstone, Northampton Sand Formation - Sandstone, Ferruginous, Scunthorpe Mudstone Formation - Mudstone And Limestone, Interbedded, Penarth Group – Mudstone, Charmouth Mudstone Formation – Mudstone, Grantham Formation - Sandstone, Siltstone And Mudstone and Whitby Mudstone Formation – Mudstone underlain the Proposed Order Limits to the east of Scunthorpe.

Geological Sites of Special Scientific Interest and Regionally Important Geological Sites

9.5.34 A review of currently available information has indicated that there are no Geological SSSIs or RIGS within the Study Area.

Hydrogeology

9.5.35 Mapping derived from the Groundsure Report Data indicates that the hydrogeology within 1 km of Section 2 of the Proposed Order Limits of this section is summarised in

Table 9.9. The spatial variation of the hydrogeology for this Section 2 is shown as Figures 9.3 and 9.4 (Volume IV).

Table 9.9: Summary of Hydrogeology for Section 2 – Keadby to Scunthorpe

Geology	Stratum	Aquifer Class
Superficial Deposits	Warp - Clay and Silt	Secondary A Aquifer
	Alluvium – Clay, Silt, Sand and Gravel	Secondary A Aquifer
	Sutton Sand Formation – Sand	Secondary A Aquifer
	Glaciofluvial Deposits, Devensian	Secondary A Aquifer
	Head - Clay, Silt, Sand and Gravel	Secondary Undifferentiated Aquifer
	Peat	Unproductive Aquifer
Bedrock	Kirton Cementstone Beds - Limestone	Principal Aquifer
	Raventhorpe Beds - Limestone and Argillaceous Rocks, Interbedded	Principal Aquifer
	Scunthorpe Mudstone Formation - Limestone	Secondary A Aquifer
	Frodingham Ironstone Member - Ironstone	Secondary A Aquifer
	Pecten Ironstone (Bed) - Ironstone	Secondary A Aquifer
	Marlstone Rock Formation - Ferruginous Limestone and Ferruginous Sandstone	Secondary A Aquifer
	Northampton Sand Formation - Sandstone, Ferruginous	Secondary A Aquifer
	Mercia Mudstone Group – Mudstone	Secondary B Aquifer
	Scunthorpe Mudstone Formation - Mudstone and Limestone, Interbedded	Secondary B Aquifer
	Penarth Group – Mudstone	Secondary Undifferentiated Aquifer
	Charmouth Mudstone Formation - Mudstone	Secondary Undifferentiated Aquifer
	Grantham Formation - Sandstone, Siltstone and Mudstone	Secondary Undifferentiated Aquifer
	Whitby Mudstone Formation - Mudstone	Unproductive Aquifer

9.5.36 The following NVZ have been identified within Section 2 of the Study Area for this section of the Proposed Order Limits:

- North Soak Drain (trib of R Torne/Three Rivers) NVZ – Surface Water;

- R Torne / Three Rivers from Mother Dr to R Trent NVZ - Surface Water;
- Burton Stather Drain NVZ – Surface Water;
- Bottesford Beck Catchment (trib of R Trent) NVZ – Surface Water;
- Ancholme from Bishopbridge to the Humber NVZ – Surface Water; and
- Lincolnshire Limestone – Groundwater.

Information from Statutory Authorities

9.5.37 Details determined to be relevant to Section 2 of the Proposed Order Limits are summarised below. Further information and details are provided as Appendix 9.2 (Volume III) and Figure 9.5 (Volume IV).

Discharge consents

9.5.38 There are seven discharge consents within Section 2 of the Study Area. These relate to sewage discharges of final/treated effluent or to unspecified trade discharges.

National Incidents and Records of Pollution

9.5.39 Three records exist within Section 2 of the Study Area. Two relate to significant incidents of pollution to water, including sewage materials and an unknown substance. The third incident relates to the disposal of tyres to ground which is classified as a minor incident.

Licensed Pollutant Release

9.5.40 There are no permits of release within Section 2 of the Order Limits however, there is one active permit that has been identified within this section of the Study Area for Licensed Pollutant Release which refers to animal carcass incineration at Greenacres Pet Crematorium.

COMAH Sites

9.5.41 There is one active COMAH site within Section 2 of the Study Area, this relates to Jingye Steel UK Limited.

Coal Mining and Shallowing Mining

9.5.42 Currently available records and mapping from the Coal Authority (Ref 9.41) indicate that it is not likely that Section 2 of the Study Area falls within a Coal Mining Reporting Area.

9.5.43 Two Non Coal Mining Areas have been identified within Section 2 of the Study Area (Ref 9.37). This includes the following:

- Ashby – Iron Ore (Bedded); and
- Unknown – Jet.

Historic Potentially Contaminative Land Uses

9.5.44 A review of the data currently available through historical mapping and the Groundsure Report (Ref 9.37) indicates that Section 2 of the Project experienced numerous localised potentially contaminative historical land uses including sewage works, filter beds, settling tanks, pumping stations, sand pits, railway sidings and unspecified works. Further details can be found as the Figure 9.6 (Volume IV) in addition to the Appendix 9.2 (Volume III).

Current Potentially Contaminative Land Uses

- 9.5.45 A review of the current potentially contaminative land uses within Section 2 of the Study Area suggests that contaminative land uses are generally likely to be confined to agriculture.
- 9.5.46 Other current potentially contaminative land uses have been identified and are shown on Figure 9.7 (Volume IV). These include the following:
- Power Stations;
 - Sewage Works;
 - Sludge Tanks;
 - Railway Tracks; and
 - Water Pumping Stations.

Waste

- 9.5.47 Recorded current and historic landfills and waste transfer sites identified within Section 2 of the Study Area are summarised below in Table 9.10. The location of the landfills and waste transfer sites is shown in Figure 9.8 (Volume IV).

Table 9.10: Summary of Waste for Section 2 – Keadby to Scunthorpe

Landfill Type	Details
Environment Agency Historic Landfill	None identified within the section of the Proposed Order Limits.
Active or Recent Landfill	None identified within the section of the Proposed Order Limits.
Waste Facility	None identified within the section of the Proposed Order Limits.
Waste Exemptions	5 No. Storage Waste Exemptions (Sludge, storage, spreading agricultural).
Environment Agency Permitted Waste Sites Authorised Landfill	None identified within the section of the Proposed Order Limits.

Radon

- 9.5.48 Published radon data from UK Health and Security Agency (Ref 9.42) indicates that the majority of Section 2 of the Study Area has a maximum radon potential of 1%. However, a section between Scunthorpe and British Steel has a maximum radon potential of between 10-30%.

Information from Statutory Authorities

Abstraction Data

- 9.5.49 Information provided by the Environment Agency (Ref 9.45) has identified four groundwater abstraction points within 1 km of Section 2 of the Proposed Order Limits. The abstraction points are shown in Figure 9.9 (Volume IV) and further details are tabulated in Appendix 9.2 (Volume III).

Mineral Sites and Designations

9.5.50 According to publicly available information and the Groundsure data (Ref 9.37), Section 2 of the Proposed Order Limits is located within 500 m of the area subject to the following mineral safeguarding policies:

- ‘Sand and Gravel Superficial 250 m Buffer’;
- ‘Limestone Mineral Safeguarding Area (MSA) 500 m Buffer’; and
- ‘Brick Clay Safeguarding’.

9.5.51 Mineral Safeguarding Areas within the Proposed Order Limits include:

- North Lincolnshire Council – North Lincolnshire Local Plan
 - Policy MIN2: Mineral Safeguarding.
- Lincolnshire County Council (including West Lindsey District Council) - Core Strategy and Development Management Policies
 - Policy M12: Safeguarding.

Section 3 –Scunthorpe to Killingholme

Geology

9.5.52 Published geological maps and the GIS data sourced from the BGS indicate the Study Area is underlain by the geological succession summarised below in Table 9.11. Geological mapping of Section 3 of the Study Area can be found on Figures 9.1 to 9.2 (Volume IV).

Table 9.11: Summary of Geology for Section 3 –Scunthorpe to Killingholme

Stratum Type	Description
1:63,360 Scale BGS Map Sheet 86 and 1:50,000 Scale BGS Map Sheet 80	
Made Ground	There are some areas of ‘infilled - artificial ground’ located within this section of the Proposed Order Limits.
Superficial	The section is underlain by a mixture of Superficial deposits including Sutton Sand Formation, Head, Till, Peat, Glaciofluvial sheet deposits, Glaciolacustrine Deposits, Alluvium, Tufa, Tidal Flat deposits and Interglacial Beach deposits.
Bedrock	There is a large variety of different bedrock geology underlying this section. This comprises of Santon Oolite - Limestone, Ooidal, Raventhorpe Beds - Limestone And Argillaceous Rocks, Interbedded, Kirton Cementstone Beds - Mudstone And Limestone, Interbedded, Lower Lincolnshire Limestone Member – Limestone, Hibaldstow Limestone - Limestone, Ooidal, Blisworth Limestone Formation – Limestone, Welton Chalk Formation – Chalk, Burnham Chalk Formation – Chalk, Flamborough Chalk Formation – Chalk, Frodingham Ironstone Member – Ironstone, Pecten Ironstone (Bed) – Ironstone, Marlstone Rock Formation - Ferruginous Limestone And Ferruginous Sandstone, Northampton Sand Formation -

Stratum Type	Description
	Sandstone, Ferruginous, Thorncroft Sand Member – Sandstone, Cornbrash Formation – Limestone, Kellaways Sand Member - Sandstone And Siltstone, Interbedded, Charmouth Mudstone Formation – Mudstone, Grantham Formation - Sandstone, Siltstone And Mudstone, Oxford Clay Formation – Mudstone, Kimmeridge Clay Formation – Mudstone, Ampthill Clay Formation – Mudstone, West Walton Formation - Mudstone And Siltstone, Blisworth Clay Formation – Mudstone, Rutland Formation - Argillaceous Rock, Kellaways Clay Member – Mudstone, Whitby Mudstone Formation – Mudstone, Kirton Cementstone Beds (Knoll-Reef) – Limestone, Carstone Formation – Sandstone and Ferriby Chalk Formation – Chalk.

Geological Sites of Special Scientific Interest and Regionally Important Geological Sites

9.5.53 A review of currently available information has indicated that there are no Geological SSSIs within Section 3 of the Study Area.

9.5.54 Three RIGS within the Study Area have been identified:

- Quarrying sand + clay operation, dated 1891 - unknown filled ground in 1988 (502719E, 406606N);
- Quarrying sand + clay, dated 1981 - filled 1996 (503309E, 407405N); and
- Quarrying sand + clay, dated 1948 - unknown filled ground in 1996 (503896E, 407302N).

Hydrogeology

9.5.55 Mapping derived from the Groundsure Report Data indicates that the hydrogeology within Section 3 of the Study Area is summarised as Table 9.12. The spatial variation of the hydrogeology for this section is shown as Figures 9.1 and 9.2 (Volume IV).

Table 9.12: Summary of Hydrogeology for Section 3 –Scunthorpe to Killingholme

Geology	Stratum	Aquifer Class
Superficial Deposits	Sutton Sand Formation – Sand	Secondary A Aquifer
	Glaciolacustrine Deposits – Sand and Gravel	Secondary A Aquifer
	Tufa, Calcareous	Secondary A Aquifer
	Glaciofluvial Sheet Deposits, Devensian – Sand and Gravel	Secondary A Aquifer
	Alluvium - Clay, Silt, Sand and Gravel	Secondary A Aquifer
	Head – Clay, Silt, Sand and Gravel	Secondary Undifferentiated Aquifer

Geology	Stratum	Aquifer Class
	Till, Devensian	Secondary Undifferentiated Aquifer
	Interglacial Beach deposits	Secondary Undifferentiated Aquifer
	Peat	Unproductive Aquifer
	Tidal Flat Deposits – Clay, Silt and Sand	Unproductive Aquifer
	Glaciolacustrine Deposits – Clay and Silt	Unproductive Aquifer
Bedrock	Santon Oolite - Limestone, Ooidal	Principal Aquifer
	Raventhorpe Beds - Limestone and Argillaceous Rocks, Interbedded	Principal Aquifer
	Kirton Cementstone Beds - Mudstone and Limestone, Interbedded	Principal Aquifer
	Lower Lincolnshire Limestone Member - Limestone	Principal Aquifer
	Hibaldstow Limestone - Limestone, Ooidal	Principal Aquifer
	Blisworth Limestone Formation - Limestone	Principal Aquifer
	Welton Chalk Formation - Chalk	Principal Aquifer
	Burnham Chalk Formation - Chalk	Principal Aquifer
	Flamborough Chalk Formation - Chalk	Principal Aquifer
	Carstone Formation – Sandstone	Principal Aquifer
	Ferriby Chalk Formation – Chalk	Principal Aquifer
	Frodingham Ironstone Member - Ironstone	Secondary A Aquifer
	Pecten Ironstone (Bed) - Ironstone	Secondary A Aquifer
	Marlstone Rock Formation - Ferruginous Limestone And Ferruginous Sandstone	Secondary A Aquifer
	Northampton Sand Formation - Sandstone, Ferruginous	Secondary A Aquifer
	Thorncroft Sand Member - Sandstone	Secondary A Aquifer
	Cornbrash Formation - Limestone	Secondary A Aquifer
	Kellaways Sand Member - Sandstone And Siltstone, Interbedded	Secondary A Aquifer
	Charmouth Mudstone Formation - Mudstone	Secondary Undifferentiated Aquifer
	Grantham Formation - Sandstone, Siltstone And Mudstone	Secondary Undifferentiated Aquifer

Geology	Stratum	Aquifer Class
	Oxford Clay Formation - Mudstone	Unproductive Aquifer
	Kimmeridge Clay Formation - Mudstone	Unproductive Aquifer
	Amphill Clay Formation - Mudstone	Unproductive Aquifer
	West Walton Formation - Mudstone And Siltstone	Unproductive Aquifer
	Blisworth Clay Formation - Mudstone	Unproductive Aquifer
	Rutland Formation - Argillaceous Rock	Unproductive Aquifer
	Kellaways Clay Member - Mudstone	Unproductive Aquifer
	Whitby Mudstone Formation - Mudstone	Unproductive Aquifer
	Kirton Cementstone Beds (Knoll-Reef) - Limestone	Unproductive Aquifer

9.5.56 The following WFD groundwater bodies have been identified within Section 3 of the Proposed Order Limits (Ref 9.37 and Ref 9.38):

- Grimsby Ancholme Frodingham Ironstone Unit;
- Grimsby Ancholme Louth Limestone Unit;
- Blisworth Limestone Rutland formation;
- Lower Trent Erewash - Secondary Combined;
- Cornbrash; and
- North Lincolnshire Chalk Unit.

9.5.57 The following SPZ have been identified within Section 3 of the Proposed Order Limits:

- Zone 1 Inner Protection Zone SPZ;
- Zone 2 Outer Catchment SPZ; and
- Zone 3 Total Catchment SPZ.

9.5.58 The following NVZ have been identified within Section 3 of the Proposed Order Limits:

- Bottesford Beck Catchment (trib of R Trent) NVZ – Surface Water;
- Ancholme from Bishopbridge to the Humber NVZ – Surface Water;
- Lincolnshire Limestone – Groundwater;
- River Eau from Kirton Lindsey Trib to R Trent NVZ - Surface Water;
- Lincolnshire Chalk - Groundwater;
- Skitter Beck / East Halton Beck NVZ – Surface Water; and
- Barrow Beck NVZ – Surface Water.

Information by Statutory Authorities

- 9.5.59 Details determined to be relevant to Section 3 of the Proposed Order Limits are summarised below. Further information and details are provided as Appendix 9.2 (Volume III) and Figure 9.5 (Volume IV).

Discharge consents

- 9.5.60 There are eight discharge consents within the Study Area. These relate to sewage discharges of final/treated effluent or to unspecified trade discharges.

National Incidents and Records of Pollution

- 9.5.61 Five records exist within Section 3 of the Study Area, these include diesel, household waste, inert materials and general biodegradable waste and range between no impact to minor impact on water.

Pollution Inventory Substance

- 9.5.62 There are a total of six entries for Pollution Inventory Substances within Section 3 of the Study Area. There are three entries for Kettleby Farm for intensive farming – poultry. There is another entry for treatment and processing of animal raw products at C&D Foods Limited and finally two entries for combustion of fuel and Centrica Brigg power station.

Hazardous Substance Storage

- 9.5.63 There is one hazardous storage entry within Section 3 of the Study Area and this relates to Centrica Energy Operations Limited at Brigg Power Station.

Information from Local Authorities

Private Water Supplies

- 9.5.64 The following private water supplies have been identified within Section 3 of the Study Area:
- Location: 506539E, 412555N
Type of Source: Borehole
Estimated daily volume of water supplied: 10 m³ per day
Water Usage: Regulation 9, Commercial – Brewery
 - Location: 509512E, 409728N
Type of Source: Borehole
Estimated daily volume of water supplied: 1.2 m³ per day
Water Usage: Regulation 10, Domestic

Pollution Incidents

- 9.5.65 According to information provided by West Lindsey Council there were six pollution incidents within Section 3 of the Study Area to the south and east of Brigg:
- Reference 38897 (24/10/2001) – 500000E, 406220N – air category 4 (no impact) – land category 3 (minor) – water category 4 (no impact);
 - Reference 83788 (10/06/2002) – 499900E, 406060N – air category 4 (no impact) – land category 4 (no impact) – water category 4 (no impact);
 - Reference 65364 (20/03/2002) – 500740E, 406490N – air category 3 (minor) – land category 3 (minor) – water category 4 (no impact);

- Reference 29193 (20/07/2001) – 500600E, 406100N – air category 4 (no impact) – land category 3 (minor) water category 4 (no impact);
- Reference 751106 (05/02/2010) – 500622E, 406059N – air category 4 (no impact) – land category 3 (minor) – water category 3 (minor); and
- Reference 236379 (13/05/2004) – 504171E, 407802N – air category 4 (no impact) – land category 4 (no impact) – water category 1 (major).

Coal Mining and Shallowing Mining

- 9.5.66 Currently available records and mapping from the Coal Authority (Ref 9.41) indicate that it is not likely that Section 3 of the Study Area falls within a Coal Mining Reporting Area.
- 9.5.67 One Non Coal Mining Area has been identified within Section 3 of the Study Area (Ref 9.41). This includes the following:
- Unknown – Jet.

Historic Potentially Contaminative Land Uses

- 9.5.68 A review of the data currently available through historical mapping and the Groundsure Report (Ref 9.37) indicates that this section of the Study Area experienced numerous localised potentially contaminative historical land uses including unspecified pits, clay pits, refuse heaps, unspecified quarries, sand pits, railway sidings, pumping stations, sewage works, disused airfield, chalk pits, settling tanks and unspecified works. Further details can be found as the Figure 9.6 (Volume IV) in addition to the Appendix 9.2 (Volume III).

Current Potentially Contaminative Land Uses

- 9.5.69 A review of the current potentially contaminative land uses within Section 3 of Study Area suggests that contaminative land uses are generally likely to be confined to agriculture.
- 9.5.70 Other current potentially contaminative land uses have been identified and are shown on Figure 9.7 (Volume IV). These include the following:
- Roadway;
 - Railway Tracks; and
 - Water Pumping Stations.

Waste

- 9.5.71 Recorded current and historic landfills and waste transfer sites identified within Section 3 of the Study Area are summarised below in Table 9.13. The location of the landfills and waste transfer sites is shown in Figure 9.8 (Volume IV).

Table 9.13: Summary of Waste for Section 3 - Keadby to Killingholme

Landfill Type	Details
Environment Agency Historic Landfill	3 No. Historical Landfills (Inert, Commercial, Industrial, Household) which includes Brigg Road Tip (1 No. landfill which falls within Section 3 of the Proposed Order Limits – Inert, Industrial relating to Brigg Road, Messingham).

Landfill Type	Details
Active or Recent Landfill	None identified within Section 3 of the Study Area.
Waste Facility	1 No. Inert Recycling Centre - Kettleby Quarry Plant Site within Section 3 of the Study Area.
Waste Exemptions	32 No. Storage Waste Exemptions for Sludge, storage, spreading agriculture, mulch, construction, burning of waste, dredging of inland waters, disposing of waste, treatment of waste aerosol cans, treatment of waste wood and plant matter.
Environment Agency Permitted Waste Sites Authorised Landfill	None identified within Section 3 of the Study Area.

Radon

9.5.72 Published radon data from UK Health and Security Agency (Ref 9.42) indicates that Section 3 of the Study Area has a maximum radon potential of 1%. However, a section between surrounding Brigg has a maximum radon potential of between 10-30%.

Mineral Sites and Designations

9.5.73 Information obtained from Lincolnshire Minerals and Waste Local Plan (Adopted 2016) identify Safeguarded Mineral Sites.

9.5.74 From the Lincolnshire Plan, there are the following mineral safeguarding policies:

- Policy M12: Safeguarding of Existing Mineral Sites and Associate Minerals Infrastructure – Kettleby Quarry; and
- Policy SL2: Safeguarding Mineral Allocations – an extension of Kettleby Quarry.

9.5.75 The exemptions set out in Policies M12 and SL2, the application for non-minerals development should be accompanied by a Minerals Assessment to determine if the proposed development would prejudice or jeopardise the future operation of the minerals site and extraction of the allocated resources.

9.5.76 According to publicly available information and the Groundsure data (Ref 9.37), the Proposed Order Limits are located within 500 m of the area subject to the following mineral safeguarding policies:

- ‘Sand and Gravel Superficial 250 m Buffer’;
- ‘Limestone MSA 500 m Buffer’;
- ‘Chalk 500 m Buffer’; and
- ‘Brick Clay Safeguarding’.

9.5.77 Mineral Safeguarding Areas within Section 3 of the Proposed Order Limits include:

- North Lincolnshire Council – North Lincolnshire Local Plan:
 - Policy MIN2: Mineral Safeguarding

- Lincolnshire County Council (including West Lindsey District Council) - Core Strategy and Development Management Policies:
 - Policy M12: Safeguarding

Section 4 – Killingholme to Hedon (Humber Crossing)

Geology

9.5.78 Published geological maps and the GIS data sourced from the BGS indicates Section 4 of the Study Area is underlain by the geological succession summarised below in Table 9.14. Geological mapping of the Study Area can be found on Figures 9.1 to 9.2 (Volume IV).

Table 9.14: Summary of Geology for Section 4 – Killingholme to Hedon

Stratum Type	Description
1:63,360 Scale BGS Map Sheet 86 and 1:50,000 Scale BGS Map Sheet 80	
Made Ground	There are some areas of 'infilled - artificial ground' located within this section of the Proposed Order Limits.
Superficial	The section is underlain by a mixture of Superficial deposits including Kelsey Hill Gravels (Beds) – Sand And Gravel, Glaciofluvial Deposits, Beach And Tidal Flat Deposits, Till, Tidal Flat Deposits and Kelsey Hill Gravels (Beds) – Clay and Silt.
Bedrock	This section of the Proposed Order Limits in underlain by the Burnham Chalk Formation and the Flamborough Chalk Formation.

Geological Sites of Special Scientific Interest and Regionally Important Geological Sites

9.5.79 A review of currently available information has indicated that there are no Geological SSSIs or RIGS within Section 4 of the Study Area.

Hydrogeology

9.5.80 Mapping derived from the Groundsure Report Data indicates that the hydrogeology within Section 4 of the Study Area is summarised as Table 9.15. The spatial variation of the hydrogeology for this section is shown as Figures 9.1 and 9.2 (Volume IV).

Table 9.15: Summary of Hydrogeology for Section 4 – Killingholme to Hedon

Geology	Stratum	Aquifer Class
Superficial Deposits	Kelsey Hill Gravels (Beds) – Sand And Gravel	Secondary A Aquifer
	Glaciofluvial Deposits	Secondary A Aquifer
	Beach And Tidal Flat Deposits	Secondary Undifferentiated Aquifer
	Till	Secondary Undifferentiated Aquifer
	Tidal Flat Deposits	Unproductive Aquifer

Geology	Stratum	Aquifer Class
	Kelsey Hill Gravels (Beds) – Clay and Silt	Unproductive Aquifer
Bedrock	Burnham Chalk Formation	Principal Aquifer
	Flamborough Chalk Formation	Principal Aquifer

9.5.81 The following WFD groundwater bodies have been identified within the Study Area (Ref 9.37 and 9.38):

- North Lincolnshire Chalk Unit;
- Humber Lower; and
- Hull and East Riding Chalk.

9.5.82 The following NVZ have been identified within Section 4 of the Study Area:

- Lincolnshire Chalk – Groundwater;
- Skitter Beck / East Halton Beck NVZ – Surface Water;
- North Beck Drain NVZ – Surface Water;
- Burstwick Drain from Source to Humber NVZ – Surface Water; and
- Wyton Drain/Sproatley Dr from Source to Humber NVZ – Surface Water.

Sensitive Land Uses

9.5.83 The Humber Estuary crossing has been identified as the following:

- SSSI;
- RAMSAR site; and
- Special Protection Area (SPA).

Information from Statutory Authorities

9.5.84 Details determined to be relevant to this section of the Proposed Order Limits are summarised below. Further information and details are provided as Appendix 9.2 (Volume III) and Figure 9.5 (Volume IV).

Discharge consents

9.5.85 There are 12 discharge consents within Section 4 of the Study Area. These relate to sewage discharges of final/treated effluent or to unspecified trade discharges.

National Incidents and Records of Pollution

9.5.86 Six records exist within Section 4 of the Study Area, three of these relate to minor to significant spillages of oil and fuel to water. The other three relate to disposal of tyres, household waste and an unidentified material, all minor incidents.

Licensed Pollutant Release

9.5.87 There is one historic permit within Section 4 of the Study Area for Licensed Pollutant Release which refers to odourising natural gas processes at an above ground gas installation on Thorngumbald Road, Paull registered to Transco.

COMAH Sites

9.5.88 There are four active COMAH sites within Section 4 of the Study Area, these relate to Mitsubishi Chemical UK Limited, Vivergo Fuel Limited, Saltend Chemicals Limited, and Ineos Enterprises Group Limited.

Coal Mining and Shallowing Mining

9.5.89 Currently available records and mapping from the Coal Authority (Ref 9.41) indicate that there is a small segment within Section 4 of the Study Area that is classified as Coal Mining Reporting Area along the East bank of the Humber.

Historic Potentially Contaminative Land Uses

9.5.90 A review of the data currently available through historical mapping and the Groundsure Report (Ref 9.37) indicates that this section of the Project experienced numerous localised potentially contaminative historical land uses including unspecified pits, brick works, unspecified works, marshes, gas valve compound, refuse heaps, sand pits and nurseries. Further details can be found as the Figure 9.6 (Volume IV) in addition to the Appendix 9.2 (Volume III).

Current Potentially Contaminative Land Uses

9.5.91 A review of the current potentially contaminative land uses within the Proposed Order Limits suggests that contaminative land uses are generally likely to be confined to agriculture.

9.5.92 Other current potentially contaminative land uses have been identified and are shown on Figure 9.7 (Volume IV). These include the following:

- Gas Valve Compound;
- Unspecified Quarry/Mines;
- Sewage Works;
- Roadway;
- Railway Tracks;
- Water Pumping Stations; and
- Hoppers and Silos.

Waste

9.5.93 Recorded current and historic landfills and waste transfer sites identified within Section 4 of the Study Area are summarised below in Table 9.16. The location of the landfills and waste transfer sites is shown in Figure 9.8 (Volume IV) with details provided in Appendix 9.2 (Volume III).

Table 9.16: Summary of Waste for Section 4 – Killingholme to Hedon

Landfill Type	Details
Environment Agency Historic Landfill	1 No. Historical Landfill (Inert) within the Proposed Order Limits relating to Southwest Corner of Cow Hill, PAUL Holme.
Active or Recent Landfill	1 No. Active/Recent Landfill (Non-biodegradable waste) within the Study Area.

Landfill Type	Details
Waste Facility	None identified within the Study Area.
Waste Exemptions	39 No. Storage Waste Exemptions (Sludge, storage, spreading agricultural, burning, aerobic composting, treatment of non-hazardous pesticide washings by carbon filtration for disposal, incorporation of ash into soil, dredging of inland waters, construction, use of effluent to clean a highway gravel bed, mulch).
Environment Agency Permitted Waste Sites Authorised Landfill	1 No. Permitted Waste Site (Non-Biodegradable).

Radon

9.5.94 Published radon data from UK Health and Security Agency (Ref 9.42) indicates that Section 4 of the Study Area has a maximum radon potential of 1%.

Mineral Sites and Designations

9.5.95 According to publicly available information and the Groundsure data (Ref 9.37), Section 4 of the Proposed Order Limits are located within 500 m of the area subject to the following mineral safeguarding policies:

- ‘Sand and Gravel Superficial 250 m Buffer’;
- ‘Chalk 500 m Buffer’; and
- ‘Brick Clay Safeguarding’.

9.5.96 Mineral Safeguarding Areas within Section 4 of the Proposed Order Limits include:

- Policy MIN2: Mineral Safeguarding.
- Lincolnshire County Council (including West Lindsey District Council) - Core Strategy and Development Management Policies.
- Policy M12: Safeguarding.

Section 5 – Hedon to Easington

Geology

9.5.97 Published geological maps and the GIS data sourced from the BGS indicates Section 5 of the Study Area is underlain by the geological succession summarised below in Table 9.17. Geological mapping of the Study Area can be found on Figures 9.1 to 9.2 (Volume IV).

Table 9.17: Summary of Geology for Section 5 – Hedon to Easington

Stratum Type	Description
	1:63,360 Scale BGS Map Sheet 86 and 1:50,000 Scale BGS Map Sheet 80

Stratum Type	Description
Made Ground	There are several small areas of 'Made Ground - artificial ground' located along this section of the Proposed Order Limits.
Superficial	The Superficial deposits underlying this section of the Proposed Order Limits consist of Beach and Tidal Flat deposits around the Humber and towards Easington comprising clay, silt and sand, Alluvium comprising sand, silt clay and gravel and Till Devensian – Diamicton in between. There were also pockets of Kelsey Hill Gravels (Beds), Peat, Lacustrine deposits and Glaciofluvial deposits identified within the Proposed Order Limits.
Bedrock	This whole section of the Proposed Order Limits is underlain by the Flamborough Chalk Formation. Comprises white, well-bedded, flint-free chalk with common marl seams.

Geological Sites of Special Scientific Interest and Regionally Important Geological Sites

9.5.98 A review of currently available information has indicated that there is one Geological SSSIs situated along the East Coast at Dimlington Cliff. There are no RIGS within Section 5 of the Study Area.

Hydrogeology

9.5.99 Mapping derived from the Groundsure Report Data indicates that the hydrogeology within Section 5 of the Study Area can be summarised in Table 9.18. The spatial variation of the hydrogeology for this section is shown as Figures 9.1 and 9.2 (Volume IV).

Table 9.18: Summary of Hydrogeology for Section 5 – Hedon to Easington

Geology	Stratum	Aquifer Class
Superficial Deposits	Alluvium	Secondary A Aquifer
	Kelsey Hill Gravels (Beds) – Sand And Gravels	Secondary A Aquifer
	Glaciofluvial Deposits	Secondary A Aquifer
	Lacustrine Deposits	Secondary B Aquifer
	Till	Secondary Undifferentiated Aquifer
	Beach And Tidal Flat Deposits	Unproductive Aquifer
	Kelsey Hill Gravels (Beds) – Clay and Silt	Unproductive Aquifer
	Peat	Unproductive Aquifer
Bedrock	Flamborough Chalk Formation	Principal Aquifer

9.5.100 The following WFD groundwater bodies have been identified within Section 5 of the Study Area (Ref 9.37 and Ref 9.38):

- North Lincolnshire Chalk Unit;
- Hull and East Riding Chalk; and
- Yorkshire South.

9.5.101 The following SPZ have been identified within Section 5 of the Study Area:

- Zone 3 Total Catchment SPZ surrounding Drax.

9.5.102 The following NVZ have been identified within this section of the Proposed Order Limits:

- Winestead Drain from Source to Humber NVZ – Surface Water;
- Burstwick Drain from Source to Humber NVZ – Surface Water; and
- Sands/Keyingham/ Roos Drain from Source to Humber – Surface Water.

Information from Statutory Authorities

9.5.103 Details determined to be relevant to this section of the Proposed Order Limits are summarised below. Further information and details are provided as Appendix 9.2 (Volume III) and Figure 9.5 (Volume IV).

Discharge consents

9.5.104 There are three discharge consents within Section 5 of the Study Area. These relate to unspecified trade discharges and agricultural use – fish farming.

National Incidents and Records of Pollution

9.5.105 Four records exist within Section 5 of the Study Area, two of these relate to minor to significant spillages of an unidentified pollutants to water. One relates to a smoke pollution incident in 2006 and the last one relates to spillage of agricultural materials to water in 2012.

Licensed Pollutant Release

9.5.106 There is one historic permit in Section 5 of the Study Area for Licensed Pollutant Release which refers to waste oil burner at Tower Garage.

Information from Local Authorities

Private Water Supplies

9.5.107 The following private water supplies have been identified within Section 5 of the Study Area:

- Location: Patrington Haven Leisure Park, HU12 0PT
Type of Source: Borehole – Unknown
Estimated daily volume of water supplied: Unknown
Water Usage: Private – Unknown

Coal Mining and Shallowing Mining

9.5.108 Currently available records and mapping from the Coal Authority (Ref 9.41) indicate that it is not likely that Section 5 of the Study Area falls within a Coal Mining Reporting Area.

Historic Potentially Contaminative Land Uses

9.5.109 A review of the data currently available through historical mapping and the Groundsure Report (Ref 9.37) indicates that this section of the Project experienced numerous

localised potentially contaminative historical land uses including nurseries, pump house and abandoned railway. Further details can be found as the Figure 9.6 (Volume IV) in addition to the Appendix 9.2 (Volume III).

Current Potentially Contaminative Land Uses

- 9.5.110 A review of the current potentially contaminative land uses within Section 5 of the Study Area suggests that contaminative land uses are generally likely to be confined to agriculture.
- 9.5.111 Other current potentially contaminative land uses have been identified and are shown on Figure 9.7 (Volume IV). These include the following:
- Roadway; and
 - Turbines.

Waste

- 9.5.112 Recorded current and historic landfills and waste transfer sites identified within Section 5 of the Study Area are summarised below in Table 9.19. The location of the landfills and waste transfer sites is shown in Figure 9.8 (Volume IV).

Table 9.19: Summary of Waste in Section 5 – Hedon to Easington

Landfill Type	Details
Environment Agency Historic Landfill	None identified within the section of the Study Area.
Active or Recent Landfill	None identified within the section of the Study Area.
Waste Facility	None identified within the section of the Study Area.
Waste Exemptions	16 No. Storage Waste Exemptions (Sludge, storage, spreading agricultural, burning, incorporation of ash into soil, dredging of inland waters, construction, mulch).
Environment Agency Permitted Waste Sites Authorised Landfill	None identified within the section of the Study Area.

Radon

- 9.5.113 Published radon data from UK Health and Security Agency (Ref 9.42) indicates that Section 5 of the Study Area has a maximum radon potential of 1%.

Mineral Sites and Designations

- 9.5.114 Mineral Safeguarding Areas within Section 5 of the Proposed Order Limits include:
- East Riding of Yorkshire Council (including Kingston upon Hull) – Joint Minerals Local Plan:
 - AGG10: Safeguarding of Mineral Infrastructure and Facilities

Future baseline

- 9.5.115 The Project is situated within predominantly agricultural land however, at times overlapping with existing industrial sites (e.g., power stations landfill sites).
- 9.5.116 At the time of writing, there are two potentially significant nearby schemes and/or infrastructure changes that would impact on the Project during the predicted construction timescale of the Project. This includes the Spherical Tokamak for Energy Production (STEP) programme run by the United Kingdom Atomic Energy Authority (UKAEA) which could potentially be located around the Goole area and the Associated British Ports (ABP) Humber International Enterprise Park (HIEP) development which would potentially be situated just north of the crossing of the Humber Estuary in Hedon Haven.
- 9.5.117 If a potential significant scheme and/or infrastructure change arose where there would be reasonable certainty it would go ahead and be built prior to the completion of the Project, the future baseline conditions of this EIA would need to be revisited to capture those future baseline conditions.
- 9.5.118 Although there is the potential for the baseline presented in this chapter and the final ES submission to change over time; it is considered that the data presented provides a good representation of land use and geological and hydrogeological conditions at this stage of the Project; and to be a good platform upon which to base further studies/investigation.

9.6 Design development, impact avoidance and embedded mitigation

- 9.6.1 Where possible, the Project has been designed to avoid important geological features or resources, and sources of contamination, through careful routeing and site selection.
- 9.6.2 The main mitigation measure to prevent adverse effects on soils, geology, and hydrogeology, during all phases of the development of the Project would be to ensure good site practice and management and adherence to a Construction Environmental Management Plan (CEMP). An outline CEMP will be submitted with the DCO application and the CEMP will be secured through a requirement in the DCO and the Register of Commitments.
- 9.6.3 Desk study work may identify areas of soil and/or groundwater contamination and there may be a requirement to undertake ground investigation and risk assessment of potential contaminant linkages in order to determine the actual nature, extent and magnitude of any significant potential contamination.
- 9.6.4 An appropriate intrusive ground investigation would be undertaken in accordance with all relevant guidance and legislation including BS 10175:2011, Environment Agency/DEFRA LCRM series of reports.
- 9.6.5 The ground investigation will be undertaken to achieve the following objectives:
- Determine the ground conditions to allow design of foundations and structures;
 - Assess the nature, extent and magnitude of any soil and groundwater contamination present;
 - Assess the risks (if any) from potential contaminants to human health and Controlled Waters; and

- Assess the ground gas regime.

- 9.6.6 If areas of the Proposed Order Limits are shown to pose a risk, infrastructure will be moved to a different location where feasible. However, if it is not possible to move the infrastructure, remedial measures would be implemented.
- 9.6.7 A remediation strategy will be devised and discussed with the regulatory authorities (including relevant local authorities and the Environment Agency) prior to any remedial works. Contaminated material that is considered to pose a risk would be remediated in line with the remediation strategy or disposed of appropriately.
- 9.6.8 A more detailed hydrogeological assessment will be undertaken where trenchless techniques or dewatering is required in high sensitivity groundwater environments. Where dewatering is required, a dewatering scheme will be developed prior to construction commencing (in engagement with the Environment Agency and appropriate public water abstraction companies) to demonstrate that there is an effective strategy to manage water arising from the operations and, where required, sufficient proposals to treat the water prior to controlled discharge. Any such assessment will consider the effects of any draw down or impacts on nearby abstractions or resources.

9.7 Preliminary assessment of potential impacts

- 9.7.1 This Section details the preliminary assessment of potential impacts for the Project during construction, operation, and decommissioning phases.

Construction

- 9.7.2 The potential impacts for Geology and Hydrogeology associated with the construction phase are provided in Table 9.20.

Table 9.20: Construction phase - preliminary assessment of potential impacts

Resource/receptor	Sensitivity of resource/receptor	Description of potential impact/change
Human Health: Construction Workers/Site Users	Low	Chemical spillages and leaks from construction plant and machinery, and from chemicals and other contaminants stored on site causing pollution of ground or groundwater.
Geology: Superficial deposits and Bedrock	Low	
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	
Geology: Superficial deposits	Low	Changes in subsoil structure and reduction of subsoil quality due to compaction or erosion during storage.
Geology: Superficial deposits	Low	Compaction of subsoil due to construction vehicle movements degrading soil quality and causing potential water logging.
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	Requirement for dewatering, which may reduce flow to groundwater supported sites, abstractions (regulated and non-regulated) and surface water bodies and change soil hydrology locally.
Hydrology: Surface Water Features	High	

Resource/receptor	Sensitivity of resource/receptor	Description of potential impact/change
Hydrogeology: Aquifers (Principal) and Regulated abstractions	High	Requirement for dewatering, reducing quality or levels of groundwater supporting sites protected under European and UK habitat legislation, such as a RAMSAR Site or a SSSI, or SPZ 1.
Hydrology: Surface Water Features	High	
Geology: Superficial deposits and Bedrock	Medium	Disturbance of geologically important sites (Dimlington Cliff SSSI).
Human Health: Construction Workers/Site Users	Low	Disturbance of potentially contaminated soils, sediments and waters posing a risk to construction workers, groundwater, and geology. Including potential disturbance of landfill site.
Geology: Superficial deposits and Bedrock	Low	
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	
Hydrology: Surface Water Features	High	
Human Health: Construction Workers/Site Users	Low	Importation of contaminated aggregates posing a potential risk to human health and underlying geology and groundwater.
Geology: Superficial deposits and Bedrock	Low	
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	

Resource/receptor	Sensitivity of resource/receptor	Description of potential impact/change
Geology: Superficial deposits and Bedrock	Low	Trenchless techniques whereby excavations/drilling creates a pathway for drilling fluids or other fluids used during construction to reach sensitive groundwater receptors (e.g., Principal Aquifers or abstractions (regulated and non-regulated)) or sensitive surface water receptors.
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	
Hydrology: Surface Water Features	High	
Human Health: Construction Workers/Site Users	Low	Requirement to remove spoil from tunnelling operations (including tunnel shafts) or excess soils from pipeline route posing a potential risk to human health and the environment.
Geology: Superficial deposits and Bedrock	Low	
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	

Operation

- 9.7.3 The potential impacts for Geology and Hydrogeology associated with the operational phase are provided in Table 9.21.

Table 9.21: Operational phase -preliminary assessment of potential impacts

Resource/receptor	Sensitivity of resource/receptor	Description of potential impact/change
Geology: Superficial deposits and Bedrock	Low	The foundations of structures and the pipelines may provide a preferential pathway for contaminants to migrate to non-contaminated soils, geology and groundwater.
Hydrogeology: Aquifers (Principal, Superficial A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	
Development Infrastructure: Above Ground Installations (AGI) and Pipelines	Low	The potential for aggressive ground contaminants posing a risk to the pipeline.
Hydrogeology: Aquifers (Principal, Superficial A & B and undifferentiated) and Regulated and unregulated abstractions	Medium	Requirement for permanent dewatering, reducing flow to groundwater abstractions and surface water bodies, and changes to soil hydrology.
Hydrology: Surface Water Features	High	

Decommissioning

- 9.7.4 It is assumed the pipelines would be left in-situ and therefore the decommissioning would include the removal of the AGIs only. The works and therefore effects to decommission the Project would be similar to those of construction in relation to the AGIs. Refer to Table 9.20 for potential impacts.

9.8 Mitigation and enhancement measures

- 9.8.1 This Section sets out the preliminary avoidance, mitigation and compensation measures which are likely to be required to address the potential impacts as assessed in Section 9.7.
- 9.8.2 The main mitigation measure to prevent adverse effects on geology and hydrogeology, during all phases of the development of the Project is to ensure good site practice and management. As stated in the CEMP, a range of standard site management and construction methodology techniques have been identified to minimise the risk to construction workers, degradation of soil quality, pollution of uncontaminated strata and groundwater, and reduction of groundwater resource.

Construction

Ground Contamination

- 9.8.3 In order to accurately mitigate the potential contaminants, the actual nature, extent, and magnitude of any significant potential contamination will be assessed through ground investigation and risk assessment at the design stage. As an additional precaution, a watching brief would be maintained during the construction works to confirm the absence of potential sources of contamination such as Made Ground, visual or olfactory evidence of hydrocarbons etc. If identified, these areas of potentially contaminated ground and/or water would be sampled and undergo appropriate sampling and laboratory analysis.
- 9.8.4 Subsequently a dynamic risk assessment would be undertaken in accordance with the Environment Agency report LCRM to identify if these areas of potential contaminants pose a risk to construction workers or site operators and Controlled Waters. If areas of the site are shown to pose a risk, any remedial measures required would be implemented. A discovery and disposal strategy would be devised and agreed with the regulatory authorities prior to construction works to outline this process to allow the management of risks in a timely manner.
- 9.8.5 The determination of the risks through ground investigation, watching briefs, risk assessment and the potential remediation of areas of the site may result in the reduction of the significance, or even removal, of some of the potential effects identified. Should contaminated material that poses a risk be identified, it would be treated and/or disposed of appropriately.
- 9.8.6 Measures to prevent the creation of contaminant linkages during construction, identified at the design stage, include:

- Risk assessments in accordance with the Health and Safety at Work Etc. Act 1974 (and relevant subordinate legislation) to restrict exposure to potentially harmful substances to a safe level for construction workers. Construction (Design and Management) Regulation 2015 practices would be applied;
- Dust suppression measures to reduce the generation of dust from excavated contaminated soils, for example impermeable covers spread over mounds of bare contaminated soil. Implementation of these simple measures can reduce the risk of effects to construction workers and adjacent site users from potentially contaminated dusts;
- A road sweeper would be deployed to prevent spreading of contamination onto off-site roads. Vehicles carrying contaminated soils off-site would only to be loaded up to appropriate levels and be covered to prevent contaminated materials dropping onto roads;
- Where piled foundations are used, they will be designed in accordance with the Environment Agency guidance document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention' (Ref 9.46); and
- Any material imported to site, such as stone for access roads/foundations or backfilling of the tunnel shafts, would be natural quarried stone or, if recycled, the material would undergo chemical testing. The suite of contaminants and site use criteria would be agreed with regulatory authorities, in order to demonstrate that the material is suitable for use on site and does not pose a risk to construction workers or the environment.

Groundwater

Dewatering

- 9.8.7 Ground investigation surveys will be undertaken to inform the design of the Project. During surveys, ground water levels will be recorded and piezometers installed in boreholes at certain locations to allow groundwater levels to be monitored in order to get a record of level changes over a defined period to inform design. From these, groundwater profiles will be derived, from which the requirements for de-watering will be identified.
- 9.8.8 Where required a detailed dewatering scheme will be developed prior to construction (in engagement with the Environment Agency) to manage the water arising from dewatering operations prior to controlled discharge, including treatment if required. Consideration would be given to the potential effects of dewatering on adjacent water features both from draw down during abstraction and from flood risk during discharge, and mitigation applied.

Private Water Supplies

- 9.8.9 During the detailed design phase of the Project, investigations would be completed to identify all private water supplies that may be affected by the Project. A risk assessment would be conducted to assess whether these water supplies could be affected by construction activities. Selected private water supplies would then be monitored before, during and after construction.
- 9.8.10 To ensure private water supplies are protected water quality testing would be undertaken prior to, during and following construction.

Operation

- 9.8.11 The potential for foundations to act as a pathway for contaminants, aggressive ground to pose a risk to the pipeline, and the potential need for dewatering works during the operational phase would be mitigated through the design of the pipeline, foundations and dewatering scheme. Refer to the Mitigation and enhancement measures detailed above for construction.

Decommissioning

- 9.8.12 It is assumed the pipelines would be left in-situ and therefore the decommissioning would include the removal of the AGIs only. Refer to the mitigation and enhancement measures detailed above for construction.

9.9 Summary of the preliminary assessment of potential significant effects

- 9.9.1 Table 9.22 below summarises the preliminary assessment of potential significant effects associated with the Project.

Table 9.22: Summary of the preliminary assessment of potential significant effects

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Human Health: Construction Workers/Site Users	Construction/Decommissioning	Low	Chemical spillages and leaks from construction plant and machinery, and from chemicals and other contaminants stored on site causing pollution of ground or groundwater.	Good practice measures to be set out in the CEMP.	Not significant Short Term
Geology: Superficial deposits and Bedrock	Construction/Decommissioning	Low			Not significant Short Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	Medium			Not significant Short Term
Geology: Superficial deposits	Construction/Decommissioning	Low	Changes in subsoil structure and reduction of subsoil quality due to compaction or erosion during storage.	Good practice measures to be set out in the CEMP.	Not significant Short Term

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Geology: Superficial deposits	Construction/Decommissioning	Low	Compaction of subsoil due to construction vehicle movements degrading soil quality and causing potential water logging.	Good practice measures to be set out in the CEMP.	Not significant Medium Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	Medium			Not Significant Medium Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Operational/Decommissioning	Medium	Requirement for dewatering, which may reduce flow to groundwater supported sites, abstractions and surface water bodies and change soil hydrology locally.	<p>Good practice measures to be set out in the CEMP.</p> <p>Determination of groundwater regime through ground investigation and monitoring.</p> <p>Development and implementation of a dewatering scheme in engagement with the Environment Agency.</p>	Not Significant Medium Term

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Hydrology: Surface Water Features	Construction/Operational/Decommissioning	High			Not Significant Short Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	High	Requirement for dewatering, reducing quality or levels of groundwater supporting sites protected under European and UK habitat legislation, such as a RAMSAR Site or a SSSI.	Good practice measures to be set out in the CEMP. Determination of groundwater regime through ground investigation and monitoring. Development and implementation of a dewatering scheme in engagement with the Environment Agency.	Not Significant Medium Term
Hydrology: Surface Water Features	Construction/Decommissioning	High			Not Significant Medium Term

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Geology: Superficial deposits and Bedrock	Construction/Decommissioning	Low	Disturbance of geologically important sites.	Design of pipeline installation techniques to prevent disturbance of site features.	Not significant Short Term
Human Health: Construction Workers/Site Users	Construction/Decommissioning	Low	Disturbance of potentially contaminated soils, sediments and waters posing a risk to construction workers, groundwater, and geology.	Ground investigation and subsequent risk assessment during design to determine risk. Design to avoid contamination sources or remediation of contamination if required. Good practice measures to be set out in the CEMP. A watching brief would be required during works.	Not Significant Short Term
Geology: Superficial deposits and Bedrock	Construction/Decommissioning	Low			Not Significant Short Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	Medium			Not Significant Medium Term

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Hydrology: Surface Water Features	Construction/Decommissioning	High			Not Significant Medium Term
Human Health: Construction Workers/Site Users	Construction/Decommissioning	Low	Importation of contaminated aggregates posing a potential risk to human health and underlying geology and groundwater.	Good practice measures to be set out in the CEMP.	Not Significant Short Term
Geology: Superficial deposits and Bedrock	Construction/Decommissioning	Low			Not Significant Medium Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	Medium			Not Significant Medium Term
Geology: Superficial deposits and Bedrock	Construction/Decommissioning	Low			Trenchless techniques whereby excavations/drilling creates a pathway for drilling fluids or other

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	Medium	fluids used during construction to reach sensitive groundwater receptors (e.g., Principal Aquifers or abstractions) or sensitive surface water receptors.		Not Significant Short Term
Hydrology: Surface Water Features	Construction Decommissioning	High			Not Significant Short Term
Human Health: Construction Workers/Site Users	Construction/Decommissioning	Low			Not significant Short Term
Geology: Superficial deposits and Bedrock	Construction/Decommissioning	Low	Requirement to remove spoil from tunnelling operations (including tunnel shafts) posing a potential risk to human health and the environment.	Good practice measures to be set out in the CEMP. A watching brief would be required during works.	Not significant Short Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Construction/Decommissioning	Medium			Not Significant Short Term

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Geology: Superficial deposits and Bedrock	Operational	Low	The foundations of structures and pipelines may provide a preferential pathway for contaminants to migrate to non-contaminated soils, geology, and groundwater.	Ground investigation to inform design of foundations prevent creation of pollutant linkages. Where piled foundations are used, they will be designed in accordance with the Environment Agency guidance document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention'	Not significant Medium Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated)	Operational	Medium			Not Significant Medium Term
Development Infrastructure: AGIs and Pipelines	Operational	Medium	The potential for aggressive ground contaminants posing a risk to the pipeline.	Design of suitable pipeline materials and in ground structures. Appropriate testing of backfill materials prior to use on site.	Not significant Medium Term
Hydrogeology: Aquifers (Principal, Secondary A & B and undifferentiated) and Regulated and unregulated abstractions	Construction/Operational/Decommissioning	Medium	Requirement for permanent dewatering, reducing flow to groundwater abstractions and surface water bodies, and changes to soil hydrology.	Good practice measures to be set out in the CEMP. Determination of groundwater regime through ground investigation and monitoring. Development and implementation of a dewatering scheme in	Not Significant Medium Term

Resource / receptor	Stage	Sensitivity of resource / receptor	Description of potential impact / change	Mitigation	Potential significant effects
Hydrology: Surface Water Features	Construction/Operational/Decommissioning	High		engagement with the Environment Agency.	Not Significant Medium Term

9.10 Next steps

Engagement

- 9.10.1 No further technical engagement is planned for the PEIR. Engagement with regulators is continuing as part of the process.

Surveys

- 9.10.2 Questionnaires may be issued to the owners of private water supplies that have been identified during this stage of the assessment to gather more information to include in the ES.
- 9.10.3 It is intended that by the next stage of the assessment that preliminary Ground Investigation data will reviewed on more detailed desk-based information. Preliminary ground investigation data will be available for review upon completion of the investigation in 2023 following submission of the ES.

Assessment

- 9.10.4 As part of the future assessment, the baseline conditions will be reviewed and refined based on the more detailed design of the pipelines and AGIs along with feedback from future questionnaires and surveys submitted. This will help to provide a more detailed assessment of the potential impacts of the Project within the ES.

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