



Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 21: Ground Conditions and Land Quality

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed
Forms and Procedure) Regulations 2009 (as
amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning
(Applications: Prescribed Forms and
Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 21: Ground Conditions and Land Quality

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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21 Ground Conditions and Land Quality

21.1 Introduction

- 21.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project in relation to the topic of Ground Conditions and Land Quality and relates to the terrestrial/land side of the Project as shown in **Figure 21.1 [TR030008/APP/6.3]**.
- 21.1.2 The assessment has examined the potential for the construction, operation and decommissioning phases of the Project to result in likely significant effects in relation to the following landside receptors associated with the topic:
- Human receptors – concerning the health of onsite and offsite workers and visitors in relation to their potential contact and/or exposure to contaminants.
 - Geological receptors – comprising superficial geology and bedrock geology, and geological sites designated for their conservation interest.
 - Soil receptors – comprising agriculturally graded soil resources.
 - Hydrogeological and hydrological receptors – comprising superficial and bedrock aquifers (both principal and secondary), surface water features and existing abstraction sites.
- 21.1.3 The assessment has been undertaken using information regarding Project construction, operation and decommissioning presented in **Chapter 2: The Project [TR030008/APP/6.2]**. Reference is made to the Works No.s defined and described in that chapter, these being the locations where the Project's landside elements and/or activities would be implemented. The location of the Works Nos. are illustrated on the **Works Plans [TR030008/APP/4.2]**.
- 21.1.4 The assessment has been prepared using topic-specific guidance (where available), taking account of the general methodology and approach to assessment described in **Chapter 5: EIA Process [TR030008/APP/6.2]**.
- 21.1.5 Given the interrelationships between the landside receptors identified in this chapter and those considered in other technical assessments reported in the Environmental Statement ("ES"), reference is made to the following complementary assessments which report effects on related landside and marine-based receptors, sites and interests:
- Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2]** – which presents information regarding sites protected for their nature conservation interest.
 - Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]** – which presents information regarding potential contamination and Nitrate Vulnerable Zones ("NVZ") associated with the marine environment.
 - Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** – which presents information regarding existing water bodies, existing and proposed drainage regimes, and dewatering.

- d. **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** – which presents information relating to hazardous substances that can potentially affect human health.
- e. **Chapter 23: Socio-economics [TR030008/APP/6.2]** – which presents information regarding existing farming regimes and agricultural operations.
- f. **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** – which details the approach to, and findings of, the assessments undertaken to identify both the cumulative and in-combination effects of the Project.

21.1.6 This chapter is supported by the following Figures [TR030008/APP/6.3]:

- a. **Figure 1.1: Site Location Plan.**
- b. **Figure 2.3: Works Areas.**
- c. **Figure 21.1: Superficial Geology and Artificial Geology (including study area).**
- d. **Figure 21.2: Bedrock Geology (including study area).**
- e. **Figure 21.3: Groundwater Features (including study area).**
- f. **Figure 21.4: West Site Constraints Plan.**
- g. **Figure 21.5: East Site Constraints Plan.**
- h. **Figure 21.6: Source Protection Zones (including study area).**
- i. **Figure 21.7: Agricultural Land Classification.**
- j. **Figure 21.8: Previous Ground Investigations.**

21.1.7 The assessment also refers to technical information, data, studies and measures reported in the following appendices:

- a. **Appendix 21.A: Agricultural Land Classification Survey Report [TR030008/APP/6.4].**
- b. **Appendix 21.B: Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4].** Reference is also made to measures contained in an Outline Remediation Strategy for the landside elements of the Site, forming **Appendix 21.C [TR030008/APP/6.4].** The Outline Remediation Strategy was informed by the Ground Investigation undertaken within Work No. 3 East Site – Ammonia Storage, Work No. 4 Laporte Road Culvert, Work No. 5 East Site – Hydrogen Production and Work No. 7 West Site. Therefore, the Outline Remediation Strategy relates to known contamination in Work No's 3, 3A, 5 and 5A and potential unknown contamination across the whole Site. The outline document will inform the development of a Final Remediation Strategy.

21.2 Consultation and Engagement

- 21.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the ground conditions and land quality assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on ground conditions and land quality.
- 21.2.2 A Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) was adopted by the Planning Inspectorate (on behalf of the Secretary of State) on 10 October 2022. This identified a number of overarching and topic-specific matters that were subsequently brought into the overall scope of the assessment.
- 21.2.3 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 (“2008 Act”) (Ref 21-1). The Applicant prepared a Preliminary Environmental Information Report (“PEI Report”), which was publicised at the consultation stage.
- 21.2.4 Between completion of the scoping exercise and publication of the PEI Report, the Applicant’s Ground Investigation (see **Appendix 21.B: Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4]**) identified a potential impact pathway and risk to the Project relating to aggressive ground conditions and the accumulation of ground gases at the Site, which it determined could have the potential to degrade the foundations of operational Project infrastructure (buildings and services). The consideration of potential impacts on this infrastructure was subsequently brought into the scope of the preliminary assessments and reported in the PEI Report, with ‘Development Infrastructure’ being included as a defined receptor. Subsequent to the publication of the PEI Report, the design-development process identified that the incorporation and use of appropriate construction materials (for example concrete) and inclusion of ground gas protection measures within the Project design would remove the risk of this potential pathway to result in damage. Further information regarding the design of operational Project infrastructure to avoid/mitigate this potential risk is provided in **Section 21.7**. Accordingly, impacts and effects on ‘Development Infrastructure’ receptors have been scoped out of the assessment and are not considered further.
- 21.2.5 Through consideration of the responses to the Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified.
- 21.2.6 A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act (Ref 21-1), and a PEI Report Addendum was publicised to support the consultation.

- 21.2.7 Consultation undertaken to inform this chapter, including a summary of comments raised in the formal scoping opinion (**Appendix 1.B [TR030008/APP/6.4]**) and those gathered in response to the formal consultation exercises and other pre-application engagement are summarised in **Table 21-1**, alongside a summary of how the Applicant's assessment has responded to this feedback.

Table 21-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report proposes to scope out impacts on soil during the operational phase as any effects would have already occurred during construction. The Inspectorate agrees that new effects on soils would be likely to occur during normal operations and therefore this matter can be scoped out of the ES.	<p>This is noted by the Applicant, and based on its agreement to scoping out operational impacts on soil, the Applicant assumes that the Planning Inspectorate’s response was intended to state “...that new effects on soils would be [un]likely to occur...”.</p> <p>Accordingly, impacts and effects on soil during the operational phase of the Project have been scoped out of the assessment.</p>
		The Scoping Report states that an Agricultural Land Classification survey may be required to determine the subdivision of land classified as Grade 3 into either Grade 3a or 3b. The ES should confirm the agricultural land grade based on a recognised approach (such as Natural England’s TIN049) and demonstrate how the Proposed Development has sought to avoid use of areas of best and most versatile land. The impact of the Proposed Development on existing farming activities in the area should also be explained in the ES.	<p>An agricultural land classification (“ALC”) survey has been undertaken within the West Site and Laporte Road Temporary Construction Area in accordance with the Inspectorate’s recommended guidance, the findings of which are reported in Appendix 21.A: Agricultural Land Classification Survey Report [TR030008/APP/6.4].</p> <p>The results indicate the soils in the surveyed locations are ALC Grade 3b, and therefore not considered best and most versatile (“BMV”). Notwithstanding this classification, the Applicant has identified best practice measures to mitigate effects on agricultural soils, noting that the West Site supports an existing planning consent and local removal of soils has already taken place to create an access road; these are presented in Section 21.9.</p> <p>The impact of the Project on existing farming activities and agricultural operations has been</p>

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			considered within Chapter 23: Socio-Economics [TR030008/APP/6.2] .
		<p>Paragraph 20.6.9 on ‘relevant legislation, policy and technical guidance’ focuses on legislation and policy. The ES should list the guidance applied. Where relevant, the ES should take into account the following guidance:</p> <ul style="list-style-type: none"> Ministry of Agriculture, Fisheries and Food (1988) The Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land. Natural England (2012) Technical Information Note TIN049, Agricultural Land Classification: protecting the best and most versatile agricultural land Stapleton, C., Reed, E., Gemmill, L., Adams, K. (eds) (2021) IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment. 	The Applicant can confirm that the guidance noted by the Planning Inspectorate has been reviewed, and where relevant, this has been taken into account as part of the assessment of the Project’s effects on agricultural land and soils.
	Environment Agency	We have reviewed this chapter and can advise that we are satisfied with the scope and methodology proposed to assess ground conditions and land quality.	The Environment Agency’s response is noted by the Applicant.
	The Coal Authority	The Coal Authority has confirmed that the site is located within a coalfield. However, the site is not located within a Development High Risk Area. There are no recorded coal mining legacy hazards at depth. Therefore, the Coal Authority considers that no further consideration to a coal mining legacy as part of the ES and there is no requirement to contact the Coal Authority regarding the planning application.	Section 21.6 provides information on coal mining activity relating to the Site Boundary.
		It is recommended to include the following text if planning permission is granted as part of the formal application: “ <i>The proposed development lies within a coal mining area which may contain unrecorded coal mining related hazards. If any coal mining feature is</i>	Section 21.6 presents information on the geology of the site. The chalk is at a significant thickness overlying potential coal measures,

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		<i>encountered during development, this should be reported immediately to the Coal Authority on 0345 762 6848”.</i>	such that works at the Site are unlikely to impact coal mining features. The Coal Authority’s recommended text is noted and has been included as a measure within the Outline CEMP [TR030008/APP/6.5] .
	Natural England	Natural England recommend that the impact of the proposed development on soils and the best and most versatile agricultural land should be considered with reference to paragraphs 5.13.8 and 5.13.15 National Policy Statement for Ports. It is also recommended that the ES describes the potential disturbance and damage to soils as part of the proposed development. The potential disturbance or loss of agricultural land, including the best and most versatile land, should be considered in the ES. The avoidance and minimisation of potential impact to soils and the best and most versatile agricultural land should be discussed in the ES, including site design, green infrastructure, biodiversity net gain, soil handling and sustainable re-use. Natural England note that an ALC may be required.	Due regard has been given to the National Policy Statement for Ports in the assessment with regard to soils, as summarised in Section 21.8 . An ALC survey has been undertaken within the West Site and Laporte Road Temporary Construction Area, the findings of which are presented in Appendix 21.A [TR030008/APP/6.4] . Information on the ALC grading for the Site and soil chemistry is summarised in Section 21.6 . The potential impacts and effects on soils are discussed in Section 21.8 and are presented in Table 21-19 . Measures to mitigate these impacts and effects are presented in Section 21.9 .
		Natural England also note that the ES should discuss the potential for an increased pollution risk during the construction and operational phases of the proposed development.	The assessment of the construction and operational phases of the Project have considered the potential for increased pollution risk, as described in Section 21.8 .
	North East Lincolnshire Council (“NELC”)	In terms land quality (Section 20) NELC agree with the scope and methodology presented.	The Applicant notes the response from NELC.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	UK Health Security Agency	The UK Health Security Agency note that the potential land quality impacts during the operational phase, including soil impacts, that were scoped out may require further consideration in relation to Chapter 21 Major Accidents and Disasters. It is noted that an incident could be detrimental to land quality as well as the hydrology and neighbouring watercourses.	<p>The assessment has considered the potential for neighbouring areas of land and hydrological receptors to be affected through the adoption of 500m and 1km study areas around the Site Boundary for specific interests, as defined in Section 21.5.</p> <p>The findings of the assessment are presented in Section 21.8; this includes effects relating to uncontrolled run-off and accidental releases of potential contaminants to hydrological features surrounding the Site Boundary during the operational phase of the Project.</p> <p>Operational mitigation measures in relation to incidents of potential detriment to land quality, hydrology and watercourses (including appropriate emergency environmental management plans and procedures) are presented in Section 21.9.</p>
	The Coal Authority	I can confirm that having checked the Proposed Site Boundary of the project site, whilst the site lies within the coalfield, our records indicate that coal mining activity occurred at such depth that it is much less likely to pose a risk to the stability of ground and new development. Our records indicate no known or likely coal-mining legacy features at surface or shallow depth. The developer needs to remain mindful that their site falls within the coalfield, and if unrecorded coal-mining hazards are found, they should contact the Coal Authority for further advice.	<p>Section 21.6 provides information on coal mining activity relating to the Site Boundary.</p> <p>The Coal Authority will be contacted in the event unrecorded coal mining hazards are encountered at the Site during construction of the Project.</p>
	Environment Agency	We have reviewed Chapter 21 of the PEI Report in relation to the protection of controlled waters only. We are satisfied that an appropriate approach for the management of potential risks posed by contamination at the site is being adopted. It is understood that a ground investigation is to be undertaken to support the land	A risk assessment has been undertaken as part of the ground investigation reported in Appendix 21.B [TR030008/APP/6.4] in accordance with the Environment Agency's Land Contamination Risk Management

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		<p>contamination risk assessment, and a remediation strategy will be prepared to support the DCO application. We recommend that you:</p> <ul style="list-style-type: none"> • 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 risks to other receptors, such as human health; • 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; • Refer to the contaminated land pages on gov.uk for more information. 	<p>(“LCRM”) (Ref 21-22), and with reference to the its guiding principles for land contamination and guidance within contaminated land pages on the gov.uk website (as suggested by the Environment Agency).</p>
		<p>Paragraph 21.4.12 mentions that dewatering may be required to take place during construction. Should this be the case, the EA must be contacted in order to discuss abstraction licensing and environmental discharge permit requirements for such activities. Please note, the granting of an abstraction license and discharge permit is not guaranteed.</p>	<p>The Outline Construction Environmental Management Plan (“CEMP”) [TR030008/APP/6.5] includes measures placing an obligation on the contractor to engage the Environment Agency in the event that a requirement for dewatering during construction is identified.</p>
	<p>Polynt Composites</p>	<p>The project proposals for which development consent is being sought will necessitate the temporary acquisition of the Order Land. This is Polynt-owned land within the red line boundary for the DCO, which is currently in agricultural use and is actively farmed by a tenant farmer. According to the supporting documentation made available to date, the Order Land will be used as a construction compound during the construction phase of the IGET Project. Whilst the Order Land is most immediately affected by the IGET Project, assessing the impact of the same on the operation of the Plant and its employees is also of critical importance to Polynt.</p> <p>In the absence of appropriate mitigation, protective and safeguarding measures, the IGET Project could have a significant impact on the</p>	<p>A detailed ALC survey has been undertaken by the Applicant, the findings of which are reported in full in Appendix 21.A [TR030008/APP/6.4] and are summarised as part of the baseline conditions presented in Section 21.6.</p> <p>Matters relating to the potential future viability of farming operations on land required during construction of the Project, and potential effects on operation of the existing Polynt plant, have been considered within Chapter 23: Socio-Economics.</p>

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		<p>operations of the Plant and on the medium to longer term development potential of the Order Land.</p> <p>Given the proposed land take required to deliver the IGET Project and the impact this will have on the amenity of the area, traffic and transport and other associated impacts during the construction and operational phases, an optimum solution as regards the internal, physical reconfiguration of the Order Land will need to be identified, programmed and executed. Furthermore, any commercial and operational disruption to the Plant will need to be minimised and proactively managed not only during reconfiguration works but also during construction and operational phases of the IGET Project.</p>	
		<p>In relation to the Order Land, we require further clarity on the extent of the ground investigation work that is proposed at this location. We will require maximum comfort that the land will be remediated so that there is no impact on the land as a result of its temporary use as a construction compound. If the scheme proceeds, the Order Land must be restored to its current state (i.e. suitable for agricultural use) as a minimum. Thorough investigation work is necessary to ensure that any pre-existing conditions are identified and catalogued and a baseline set that can be referred back to and remediated where necessary post construction. This is particularly important as there is a risk of uncontrolled run off and accidental release of potential contaminants during both the construction and operational phase.</p>	<p>A ground investigation has been undertaken to establish existing ground conditions at the Site, the findings of which are reported in Appendix 21.B [TR030008/APP/6.4]</p> <p>Information relating to remediation is presented in the Outline Remediation Strategy contained within Appendix 21.C [TR030008/APP/6.4].</p> <p>A Validation Report will be produced following any remediation works undertaken within the Site, this is contained within the Outline CEMP [TR030008/APP/6.5].</p>
	<p>Alex Forster Wales and West Utilities</p>	<p>Our records show those pipes owned by Wales & West Utilities (WWU) in its role as a Licensed Gas Transporter (GT). Service pipes, valves, syphons, stub connections, etc. may not be shown but their presence should be anticipated. No warranties are therefore given in respect of it.</p>	<p>No WWU infrastructure was identified during the ground investigation undertaken in between 2022 and 2023.</p> <p>Prior to the commencement of any underground works during construction of the Project, the Applicant will undertake appropriate surveys in locations where construction works are planned, to confirm no WWU infrastructure is</p>

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			present. This is contained within the Outline CEMP [TR030008/APP/6.5] .
		They also provide indications of gas pipes owned by other GTs, or otherwise privately owned, which may be present in this area. This information is not information of WWU and WWU is unable to verify this information or to confirm whether it is accurate or complete.	Prior to the commencement of any underground works during construction of the Project, the Applicant will undertake appropriate surveys to identify any such infrastructure where construction works are planned.
Second Statutory Consultation May – July 2023	The Coal Authority	<p>Thank you for your notification of 26 May 2023 seeking the views of the Coal Authority on the above.</p> <p>I have checked the site location plan against our coal mining information and can confirm that, whilst the proposed development site falls within the coalfield, it is located outside the Development High Risk Area as defined by the Coal Authority.</p> <p>On this basis, the Planning team at the Coal Authority have no comments to make.</p>	<p>The comment from the Coal Authority is noted.</p> <p>The Coal Authority will be contacted in the event unrecorded coal mining hazards are encountered at the Site during construction of the Project.</p>

21.3 Legislation, Policy and Guidance

- 21.3.1 **Table 21-2** presents the legislation, policy and guidance relevant to ground conditions and land quality, and details how their requirements have been met in the assessment.
- 21.3.2 At the time of scoping, the Applicant identified in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) that planning policies within North Lincolnshire Council were potentially applicable to the assessment; however, following ongoing refinement of the Site Boundary, the Applicant can confirm that these policies are no longer relevant, and as such, these are not considered further in this chapter.

Table 21-2: Relevant legislation, policy and guidance regarding ground conditions and land quality

Legislation/Policy/Guidance	Consideration within this chapter
European Legislation	
Although the UK left the EU on 31 January 2020, the legislation in this section has been retained by the UK as specified and remains applicable to the assessment, as summarised in Chapter 4: Legislative and Consenting Framework .	
The Water Framework Directive (2000/60/EC) (Ref 21-31)	
The framework for community action in the field of water policy. The principal objective of the Water Framework Directive (“WFD”) is for all groundwater, surface water and coastal water bodies to achieve ‘good’ status by 2015 and maintain this status. It includes broader ecological objectives as well as aims to prevent deterioration of all water bodies. The WFD aims to develop sustainable water use and reduce and eliminate the presence of hazardous substances within water bodies. It must be considered in any scheme that has the potential to have an impact on any part of the water environment. This is transposed into UK law by <i>The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 21-32)</i> .	WFD surface water bodies are described in Section 21.6 . The potential impact to the WFD surface water bodies is outlined in Section 21.8 .
The Groundwater Directive (2006/118/EC) (Ref 21-33)	
This Directive classifies groundwater bodies, establishes pollutant threshold values, and identifies trends and starting points for their reversal. Specific measures to control groundwater pollution are described, including good groundwater chemical status criteria and provisions to control groundwater pollutant inputs. The Directive provides further details on groundwater pollution control that are outlined within the <i>Water Framework Directive (2000/60/EC)</i> . This is transposed into UK law by <i>The Groundwater (Water Framework Directive) (England) Direction 2016 (Ref 21-34)</i> and <i>The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 21-32)</i> .	The WFD groundwater bodies are described in Section 21.6 . Potential impacts to groundwater are presented in Section 21.8 .

Legislation/Policy/Guidance	Consideration within this chapter
The Environmental Liability Directive (2004/35/EC) (Ref 21-35)	
<p>This Directive relates to the prevention and remedying of environmental damage. The Directive refers to environmental damage to habitats and protected species, water damage (chemical and ecological) and land damage caused by land contamination. In this instance, damage is defined as “a measurable adverse change in a natural resource or measurable impairment of a natural resource service which may occur directly or indirectly”. It also establishes a framework based on the ‘polluter pays’ principle to prevent and remedy environmental damage. Operators are therefore liable for the cost of prevention measures and remediation strategies. This is transposed into UK law by <i>The Environmental Damage (Prevention and Remediation) (England) Regulations 2015</i> (Ref 21-36).</p>	<p>Mitigation measures to prevent environmental damage caused by land contamination are presented in Section 21.9.</p>
Classification Labelling & Packaging (“CLP”) Regulation (2008/1272/EC) (Ref 21-37)	
<p>The Regulation aims to ensure the environment and human health are protected through the classification and labelling of substances. The Regulation also aims to ensure free movement of substances and mixtures. This is transposed into UK law by <i>The Classification, Labelling and Packaging of Chemicals (Amendments to Secondary Legislation) Regulations 2015</i> (Ref 21-38).</p>	<p>The potential impact to human health and the environment from any substances used on Site during the construction, operational and decommissioning phases of the Project, and associated mitigation measures, are presented in Section 21.8 and Section 21.9 respectively.</p>
The Priority Substances Directive (2008/105/EC) (Ref 21-39)	
<p>The Directive details the environmental quality standards (EQS) for priority substances and other pollutants provided in the WFD. The Directive aims for water bodies to achieve good surface water chemical status. This is transposed into UK law by <i>The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015</i> (Ref 21-40).</p>	<p>The WFD surface water bodies are described in Section 21.6. The WFD groundwater bodies are described in Section 21.6. The potential impacts to the WFD surface water bodies and groundwater bodies are outlined in Section 21.8.</p>
UK Legislation	
Environmental Protection Act 1990 (Ref 21-41)	
<p>Part 2A of the <i>Environmental Protection Act 1990</i> provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment. Enforcing authorities are required to identify and deal with such land.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. The potential impacts to human health and the environment are outlined in Section 21.8.</p>

Legislation/Policy/Guidance	Consideration within this chapter
The Environment Act 1995 (Ref 21-42)	
<p>The Act established the Environment Agency (“EA”) and Scottish Environment Protection Agency (“SEPA”) as corporate bodies. It makes provision with respect to contaminated land and abandoned mines. Further provisions relate to National Parks, pollution controls, natural resource conservation and environment conservation/enhancement.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. The potential impacts to the environment from the Project are outlined in Section 21.8.</p>
The Environment Act 2021 (Ref 21-43)	
<p>The Act provides a legal framework for environmental governance and for specific improvement of the environment, including measures on waste and resource efficiency, air quality and environmental recall, water, nature and biodiversity, and nature conservation covenants.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. Mitigation measures to protect the environment as part of the Project are outlined in Section 21.9.</p>
The Contaminated Land (England) (Amendment) Regulations 2006 (Ref 21-44)	
<p>The Regulations set out the processes of risk assessment and identification/evaluation of remediation options. This is an amendment of the <i>Contaminated Land (England) Regulations, 2006 (Ref 21-45)</i>.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. The potential sources, pathways and receptors are outlined in Section 21.6, and the potential impacts to the receptors are discussed in Section 21.8.</p>
Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref 21-46)	
<p>The Regulations describe the legal framework for the prevention of environmental damage and requirements for remediation of damage when it occurs. It sets out the Government’s views on how they should be applied and how particular terms should be interpreted.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. Mitigation measures to mitigate and reduce the potential impact to the environment are discussed in Section 21.9.</p>
The Water Act 2003 (Ref 21-47)	
<p>The Act provides measures with regards to holding and issuing licenses for water abstractions. The four broad aims of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation. The Act also considers pollution of controlled waters and coal mine water discharge and describes provisions for land drainage and flood defence. This amends the <i>Water Resources Act 1991 (Ref 21-48)</i> and <i>Water Industry Act 1991 (Ref 21-49)</i>.</p>	<p>Groundwater and surface water abstractions within a 1km radius from the Site Boundary are described in Section 21.6.</p> <p>An assessment has been undertaken to identify whether the Site poses a risk to controlled waters.</p>

Legislation/Policy/Guidance	Consideration within this chapter
The Water Act 2014 (Ref 21-50)	
<p>The aim of the Act was to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as droughts and floods. The Act includes provisions for the following: abstraction water license modifications, waterworks records, flood insurance for households, internal drainage boards, regulations for the water environment and Regional Flood and Coastal Committees.</p>	<p>Groundwater and surface water abstractions within a 1km radius from the Site Boundary are described in Section 21.6.</p> <p>An assessment has been undertaken to identify whether the Site poses a risk to controlled waters.</p>
The Environmental Permitting (England and Wales) Regulations 2016 (as amended) (Ref 21-51)	
<p>Previously under the Water Resources Act 1991 (Ref 21-48) and now under the <i>Environmental Permitting (England and Wales) Regulations 2016 (as amended) (Ref 21-51)</i> it is an offence for a person to fail to obtain, comply with or to contravene an environmental permit. The legislation provides a framework for applications for environmental permits as well as receiving, varying, transferring and surrendering permits and compliance / enforcement of permits.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to controlled waters.</p> <p>Controlled waters are discussed in Section 21.6. The potential impacts to controlled waters are discussed in Section 21.8. Mitigation measures for controlled waters are described in Section 21.9.</p>
The Land Drainage Act 1991 (as amended) (Ref 21-52)	
<p>The Act sets out the enactments related to Internal Drainage Boards (“IDB”). The Act details the provisions for facilitating or securing land drainage, powers to modify existing obligations, financial provisions, drainage rates and duties with respect to the environment and recreation.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to controlled waters. Information on drainage on the Site is provided in Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2].</p> <p>Potential impacts to the drainage on the Site and in the study area are discussed in Section 21.8. Mitigation measures to protect controlled waters, including drainage, are presented in Section 21.9.</p>
The Water Environment (Water Framework Directive) Regulations 2017 (Ref 21-32)	
<p><i>The Water Environment Regulations 2017</i> implements the WFD and Groundwater Directive.</p>	<p>An assessment has been undertaken to identify whether the Site poses a risk to controlled waters. The WFD surface water and groundwater bodies are discussed in Section 21.6. The potential impact</p>

Legislation/Policy/Guidance	Consideration within this chapter
	to surface water and groundwater are discussed in Section 21.8 .
The Waste (England and Wales) Regulations 2011 (as amended) (Ref 21-53)	
<p>The Regulations set out the measures required for the prevention of, production and management of waste. They describe the purpose of a waste prevention program with waste prevention measures and make reference to monitoring by appropriate authorities using qualitative or quantitative benchmarks.</p>	<p>Earthworks during construction will be undertaken in accordance with a Materials Management Plan (“MMP”) prepared for the Project.</p> <p>The management of waste produced on Site is discussed in Section 21.8.</p>
National Policy	
National Policy Statement for Ports (“NPSfP”) (Ref 21-54)	
<p><u>Section 5.1: Biodiversity and geological conservation</u></p> <p>Relevant extracts within this section of the NPSfP are:</p> <p>Para 5.1.4 – Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity.</p> <p>Para 5.1.5 – The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.</p>	<p>The Applicant has considered the potential for the Project to affect designated geological sites.</p> <p>Section 21.6 of the assessment confirms that no internationally, nationally or locally designated sites of geological conservation importance are present within the Site Boundary, and accordingly no direct or indirect effects on such interests are predicted as a result of the Project.</p> <p>The absence of such sites has therefore precluded the Applicant’s ability to provide opportunities to conserve and enhance geological interests as part of the Project.</p>
<p><u>Section 5.6: Water quality and resources</u></p> <p>Relevant extracts within this section of the NPSfP are:</p> <p>Para 5.6.3 – Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of, the proposed project on water quality, water resources and physical characteristics of the water environment as part of the Environmental Statement (“ES”) or equivalent.</p> <p>Para 5.6.4 – The ES should describe:</p> <ul style="list-style-type: none"> • the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges; • existing water resources affected by the proposed project and the impacts of the proposed project on water 	<p>The Applicant has considered the potential for the Project to affect water quality and water resources.</p> <p>Section 21.6 present information relating to the hydrogeology within the Site Boundary, including groundwater abstractions within 1km of the Site Boundary, and information relating to WFD groundwater bodies and SPZs.</p> <p>Section 21.6 present information relating to surface waters and surface water abstractions within and surrounding the Site Boundary, and information relating to WFD surface water bodies.</p>

Legislation/Policy/Guidance	Consideration within this chapter
<p>resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies);</p> <ul style="list-style-type: none"> existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones around potable groundwater abstractions; and any cumulative effects. 	<p>Section 21.6 presents information concerning existing discharges recorded within the Site, and within 500m of the Site Boundary.</p> <p>The predicted impacts and effects on the above interests have been assessed by the Applicant, and are presented in Section 21.8 (where relevant to the scope of the ground conditions and land quality assessment), and in Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2].</p> <p>Cumulative effects have been considered by the Applicant as part of the Environmental Impact Assessment process, the findings of which are reported in Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2].</p>
<p><u>Section 5.13: Land use including open space, green infrastructure and Green Belt</u></p> <p>Relevant extracts within this section of the NPSfP are:</p> <p>Para 5.13.8 – Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5), except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality, taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.</p>	<p>The Applicant has considered the potential for the Project to affect BMV agricultural land and soils, and has sought to minimise or mitigate effects on soil resources and soil quality.</p> <p>A detailed ALC survey has been undertaken, to identify any areas of BMV land within the Site Boundary, the findings of which are summarised in Section 21.6. The survey has confirmed that no BMV land is present within the Site Boundary. The full survey is contained within Appendix 21.A [TR030008/APP/6.4].</p> <p>Matters relating to land contamination have been considered by the Applicant. Information concerning existing and potential sources of contamination (and their associated risks) is presented in Section 21.6 and Section 21.8 respectively.</p>

Legislation/Policy/Guidance	Consideration within this chapter
National Planning Policy Framework (“NPPF”) (Ref 21-55)	
<p>The National Planning Policy Framework (“NPPF”) identifies that planning decisions should recognise that some undeveloped land can perform many functions, and that substantial weight should be given to the value of using suitable brownfield land (including supporting appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land).</p> <p>The NPPF also identifies that planning decisions should contribute to the conservation and enhancement of the natural environment by protecting sites of geological value and soils.</p> <p>In relation to agricultural land, the NPPF acknowledges that where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality.</p> <p>The NPPF also details that planning decisions need to give regard to ground conditions and pollution, including any risks arising from land instability and risks to human health from contamination.</p> <p>Paragraphs 183 – 188 form part of a section called ‘Ground conditions and pollution’. Paragraphs relevant to ground conditions and land quality are summarised below.</p> <p>Paragraph 183 details requirements of planning policies in the context of proposed development on a site including adequate site investigation, suitability in the context of ground conditions, land instability and contamination and proposals for mitigation.</p> <p>Paragraph 184 relates to the responsibility of developers and/or landowners for safe development. The paragraph states that the responsibility for safe development is with the developer and/ or landowner if a site is affected by land stability or contamination.</p> <p>Paragraph 185 refers to minimising the effects of pollution and adverse impacts from the proposed development on health, living conditions, the natural environment and sensitivity of the site.</p>	<p>The requirements of the NPPF have been reviewed and these have been accounted for in the assessment by undertaking studies to establish the existing conditions of the geological and soils environment, including potential contamination sources, and how these conditions may be affected by (or influence) the Project, as reported in Sections 21.6 to 21.8.</p>
Planning Practice Guidance (“PPG”) (revised 2021) (Ref 21-56)	
<p>The Planning Practice Guidance (“PPG”) provides supporting guidance to the NPPF. Sections of relevance to the assessment comprise:</p> <ul style="list-style-type: none"> • Land Affected by Contamination – Ensuring a site is suitable for its new use and to prevent unacceptable risk from pollution. • Land Stability – The effects of land instability may result in landslides, subsidence or ground heave. Failing to deal with this issue could cause harm to human health, local property and associated infrastructure, and the wider environment. 	<p>The relevant sections of the PPG have been considered when undertaking the assessment.</p> <p>Sections 21.6 and 21.8 present the baseline and assessment for ground conditions, including reference to land instability, the natural environment and potential sources of contamination.</p>

Legislation/Policy/Guidance	Consideration within this chapter
<ul style="list-style-type: none"> • Natural Environment – A local planning authority must consult Natural England before granting planning permission for large-scale non-agricultural development on BMV land that is not in accordance with the development plan. 	
Local Policy	
North East Lincolnshire Council Local Plan (Ref 21-57)	
<p>The following policies of the NELC Local Plan are relevant to the assessment:</p> <p>Policy 34: Water management. This policy outlines the requirements of development proposals in relation to potential impacts to surface and groundwater. Such requirements include sustainable and adequate water supplies on site, efficient water use, adequate foul water treatment and appropriate sewerage systems. The Humber River Basin Management Plan (“RBMP”) should be considered. The policy also refers to the importance of protecting groundwater within Source Protection Zones (“SPZ”) during construction and operational phases.</p>	<p>The matters stipulated in NELC’s local policies have been considered in the assessment.</p> <p>Information on controlled waters is provided in the baseline section in Section 21.6.</p> <p>Mitigation measures to protect controlled waters during the construction, operational and decommissioning phases are set out in Section 21.9.</p>
<p>Policy 41: Biodiversity and Geodiversity. This policy aims to retain, protect and restore biodiversity value and the ecological network. The protection and enhancement of biological and geological sites are also described within this policy. Specific reference is made to the Estuary Employment Zone which requires management to protect the biodiversity.</p>	<p>With specific regard to geodiversity, Section 21.6 confirms that no internationally, nationally or locally designated sites of geological conservation importance are present with the Site Boundary.</p>
Guidance	
Ministry of Agriculture, Fisheries and Food (1988): The Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land (Ref 21-58).	
<p>The document provides guidance on the grading of agricultural land as part of ALC. The ALC considers the physical and chemical characteristics of land and potential limitations on agricultural land use. The grading of the land is influenced by climate, gradient, microrelief, flooding, soil properties, presence of stones, chemistry, soil wetness, moisture, and irrigation.</p> <p>The ALC is divided into the following grades (with BMV land represented by Grades 1, 2 and 3a):</p> <ul style="list-style-type: none"> • Grade 1 is defined as excellent quality agricultural land; • Grade 2 is defined as very good agricultural land; • Grade 3a is defined as good quality agricultural land; • Grade 3b is defined as moderate quality agricultural land; 	<p>This guidance has been considered when undertaking the assessment of the impacts and effects of the Project on BMV land, particularly in relation to the classification of different grades of agricultural soils.</p> <p>A detailed ALC survey has been undertaken, to identify any areas of BMV land within the Site Boundary, the findings of which are summarised in Section 21.6. The survey has confirmed that no BMV land is present within the Site Boundary.</p>

Legislation/Policy/Guidance	Consideration within this chapter
<ul style="list-style-type: none"> Grade 4 is defined as poor quality agricultural land; Grade 5 is defined as very poor-quality agricultural land; and Grade Urban is defined as built-up land / 'hard' uses such as industrial land, housing, commercial land, education, transport, cemeteries, religious buildings, permanent caravan sites, derelict land and hard-surfaced sports facilities. Grade Urban land is considered unlikely to return to an agricultural land use. 	<p>The full survey is contained within Appendix 21.A [TR030008/APP/6.4].</p>
<p>Natural England (2012) Technical Information Note TIN049 Agricultural Land Classification: Protecting the best and most versatile agricultural land (Ref 21-59)</p>	
<p>The Technical Information Note discusses the ALC criteria and guidelines in a shorter format compared to the Ministry of Agriculture, Fisheries and Food (1988) document. The methodology for the ALC field survey is outlined and information regarding consultation with Natural England is summarised.</p>	<p>This guidance has been considered when undertaking the assessment of the impacts and effects of the Project on BMV land, particularly the methodology for undertaking the ALC survey within the Site Boundary.</p> <p>A detailed ALC survey has been undertaken, to identify any areas of BMV land within the Site Boundary, the findings of which are summarised in Section 21.6. The survey has confirmed that no BMV land is present within the Site Boundary.</p> <p>The full survey is contained within Appendix 21.A [TR030008/APP/6.4].</p>
<p>IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (Ref 21-60)</p>	
<p>The IEMA guide provides information on the consideration of the effects of proposed developments on soil within EIA including soil function, soil handling during all phases of the proposed development and sustainable soil use of soils.</p>	<p>This guidance has been considered when undertaking the assessment of the impacts and effects of the Project on BMV land, particularly in relation to identifying soil grades, classifications and chemistry. This guidance has also informed the identification of appropriate mitigation measures for soil handling and management during the construction phase of the Project.</p> <p>Soil classification within the Site Boundary has been evaluated and is presented in Section 21.6. Impacts and effects on soil are summarised in Table 21-18. Mitigation measures</p>

Legislation/Policy/Guidance	Consideration within this chapter
	for soil resources are presented in Section 21.9 .
Building Research Establishment (“BRE”) Special Digest 1:2005, Third Edition, Concrete in Aggressive Ground, 2005 (Ref 21-67)	
<p>The BRE Sulphate assessment gives guidance on designing foundation and infrastructure that would be prone to a sulphate attack from materials within the ground.</p>	<p>This guidance has been considered when undertaking a BRE Sulphate assessment, which has been carried out as part of a wider ground investigation at the Site that has examined potential ground hazards and risks.</p> <p>Key outcomes of the ground hazards assessment are presented in Section 21.6.</p>
Joint Industry Working Group (JIWG) CAR-SOIL Guidance, July 2016 (Ref 21-68)	
<p>This document has been prepared with the support of the Health and Safety Executive and presents the definitive explanation of how the legal requirements of the Control of Asbestos Regulations 2012 (CAR 2012 Regulations) have been interpreted to apply to work with asbestos contaminated soil and construction & demolition materials.</p> <p>The guidance is underpinned by the fundamental requirements expressed in the Regulations, in relation to the protection of employees from risks related to exposure to asbestos, but is set within a carefully considered framework designed specifically for soil and materials contaminated with asbestos.</p>	<p>This guidance has been considered when undertaking an asbestos assessment, which has been carried out as part of a wider ground investigation at the Site.</p> <p>Key outcomes of the asbestos assessment are presented in Section 21.8.</p>
CIRIA C665, Assessing risks posed by hazardous ground gases to buildings, London 2007 (Ref 21-69)	
<p>This guidance aims to ensure a consistent approach to decision making, particularly with respect to the need for, and scope of, remedial/protective design measures while remaining flexible enough to be relevant to site-specific and development variabilities.</p>	<p>This guidance when undertaking a gas risk assessment, which was carried out as part of a wider ground investigation at the Site.</p> <p>Key outcomes of the gas risk assessment are presented in Section 21.6.</p>

21.4 Assessment Methodology and Significance Criteria

21.4.1 The assessment has followed the methodology and approach presented in Section 20.6 of the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**).

21.4.2 The methodology has diverged from the generic assessment approach to identifying receptor sensitivity and magnitude of impact outlined in **Chapter 5: EIA Process [TR030008/APP/6.2]**, and accordingly has applied the assessment criteria defined in the Design Manual for Roads and Bridges (“DMRB”) LA 104

Environmental Assessment and Monitoring (Ref 21-4), DMRB LA 109 Geology and Soils (Ref 21-2) and DMRB LA 113 Road Drainage and the Water Environment (Ref 21-3).

- 21.4.3 Receptor sensitivity reflects the quality of a receptor and its ability to absorb an effect without perceptible change. The sensitivity of the receptor is defined using the criteria and descriptors within DMRB LA 109 (Ref 21-2) and DMRB LA 113 (Ref 21-3).

Table 21-3: Sensitivity of Receptors

Sensitivity/Value	Description Criteria	Typical Examples
Very High	<u>Geology</u> Very rare and of international importance with no potential for replacement.	United National Educational, Scientific and Cultural Organisation (“UNESCO”) World Heritage Sites Site of Special Scientific Interest (“SSSI”) and Geological Conservation Review (“GCR”) of international importance and or UNESCO Global Geoparks.
	<u>Soils</u> Soils directly supporting an EU designated site or agricultural land.	Special Area of Conservation (“SAC”), Special Protection Area (“SPA”), Ramsar; and/or ALC Grade 1 and 2 or Land Capable for Agriculture (“LCA”) Grade 1 and 2.
	<u>Contamination</u> Human health: very high sensitivity.	Very high sensitivity land use (e.g. residential).
	<u>Surface water</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Watercourse having a WFD classification shown in a River Basin Management Plan (“RBMP”) and Q95 $\geq 1.0 \text{ m}^3/\text{s}$. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI) Ramsar site, salmonid water/species protected by EC legislation.
	<u>Groundwater</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Principal aquifer providing a regionally important resource and/ or supporting a site protected under EC and UK legislation Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (“GWDTE”) SPZ1
High	<u>Geology</u> Rare and of national importance with little potential for replacement.	Rare and of national importance with little potential for replacement (e.g. GCR, SSSI, Areas of Special Scientific Interest (“ASSI”), National Nature Reserves (“NNR”)).

Sensitivity/Value	Description Criteria	Typical Examples
		Geology meeting national designation citation criteria which is not designated as such.
	<u>Soils</u> Soils directly supporting an EU designated site or agricultural land.	Soils directly supporting a UK designated site (e.g. SSSI); and/or ALC Grade 3a, or LCA Grade 3.1.
	<u>Contamination</u> Human health: very high sensitivity;	High sensitivity land use such as public open space.
	<u>Surface water</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m ³ / s. Species protected under EC or UK legislation.
	<u>Groundwater</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE. SPZ2.
Medium	<u>Geology</u> Of regional importance with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	Local Geological Sites (“LGS”) (formerly Regionally Important Geological Sites (“RIGS”))
	<u>Soils</u> Soils supporting non-statutory designated sites.	Local Nature Reserves (“LNR”), LGSs, Sites of Nature Conservation Importance (“SNCIs”); and/or ALC Grade 3b or LCA Grade 3.2.
	<u>Contamination</u> Human health: medium sensitivity;	Medium sensitivity land use such as commercial or industrial.
	<u>Surface water</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water	Watercourses not having a WFD classification shown in a RBMP and Q9 5 >0.001m ³ / s.

Sensitivity/Value	Description Criteria	Typical Examples
	environment DMRB LA113 (Ref 21-3).	
	<u>Groundwater</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3
Low	<u>Geology</u> Of local importance/ interest with potential for replacement	Non designated geological exposures, former quarries/mining sites
	<u>Soils</u> Soils supporting non-designated notable or priority habitats	ALC Grade 4 and 5 or LCA Grade 4.1 to 7
	<u>Contamination</u> Human health: Low sensitivity;	Low sensitivity land use such as highways and rail.
	<u>Surface water</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Watercourses not having a WFD classification shown in a RBMP and $Q9\ 5 \leq 0.001\text{m}^3/\text{s}$.
	<u>Groundwater</u> Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Unproductive strata
	Negligible	<u>Geology</u> No geological exposures, little/no local interest.
	<u>Soils</u> Previously developed land formerly in 'hard uses' with little potential to return to agriculture.	
	<u>Contamination</u> Human health: Undeveloped surplus land/ no sensitive land use proposed.	
	<u>Surface water and groundwater</u>	

Sensitivity/Value	Description Criteria	Typical Examples
	There is no sensitivity rating for negligible described in DMRB LA 113 (Ref 21-3).	

21.4.4 The magnitude of impacts has considered the scale of the predicted change to the baseline conditions, taking into account its duration (i.e. the magnitude may be moderated if they are temporary rather than permanent, or short term rather than long term).

21.4.5 Impacts can be direct or indirect in nature:

- a. Direct impacts, for example, could comprise the accidental release of contaminants during construction and/or operation. Similarly, direct impacts could comprise the loss of agriculturally viable soils to accommodate new development.
- b. Indirect effects, for example, could involve the disturbance of the ground in a way that contaminant linkages (source-pathway-receptor) are created, such as opening a pathway for the migration of a pollution plume within Made Ground into aquifers. Similarly, indirect impacts could comprise the migration of potentially contaminated material offsite to properties at distance from the construction source.

21.4.6 The magnitude of impact has been defined using DMRB LA 109 (Ref 21-2) and DMRB LA 113 (Ref 21-3) as outlined in **Table 21-4**.

Table 21-4: Magnitude of Impacts

Magnitude	Criteria	Typical Examples
Major (DMRB LA 109) (Ref 21-1)	<u>Geology</u> Loss of geological feature/ designation and/ or quality and integrity, severe damage to key characteristics, features or elements.	Destruction of features at a protected site i.e. SSSIs of international importance; or Global Geoparks.
	<u>Soils</u> Physical removal or permanent sealing of soil resource or agricultural land.	N/A
	<u>Contamination</u> Human Health: significant contamination identified.	Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) Standard Procedure (SP)1010 with potential for significant harm to human health. Contamination heavily restricts future use of land.
Major Adverse (DMRB LA 113) (Ref 21-3)	<u>Surface water</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and	Failure of both acute-soluble and chronic-sediment related pollutants in Highways England's Water Risk Assessment Tool ("HEWRAT") and

Magnitude	Criteria	Typical Examples
	<p>water environment DMRB LA113 (Ref 21-3).</p>	<p>compliance failure with Environmental Quality Standards (“EQS”) values.</p> <p>Calculated risk of pollution from a spillage $\geq 2\%$ annually (spillage assessment).</p> <p>Loss or extensive change to a fishery.</p> <p>Loss of regionally important public water supply (spillage assessment).</p> <p>Loss of regionally important public water supply (non-spillage assessment).</p> <p>Loss or extensive change to a designated nature conservation site.</p> <p>Reduction in water body WFD classification.</p>
	<p><u>Groundwater</u>: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).</p>	<p>Loss of, or extensive change to, an aquifer.</p> <p>Loss of regionally important water supply.</p> <p>Potential high risk of pollution to groundwater from routine runoff - risk score >250 (Groundwater quality and runoff assessment).</p> <p>Calculated risk of pollution from spillages $\geq 2\%$ annually (spillage assessment).</p> <p>Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies.</p> <p>Reduction in water body WFD classification.</p> <p>Loss or significant damage to major structures through subsidence or similar effects.</p>
<p>Major Beneficial (DMRB LA113) (Ref 21-3)</p>	<p><u>Surface water</u>: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA113 (Ref 21-3).</p>	<p>Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse.</p> <p>Improvement in water body WFD classification.</p>
	<p><u>Groundwater</u>: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).</p>	<p>Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring.</p> <p>Recharge of an aquifer.</p>

Magnitude	Criteria	Typical Examples
		Improvement in water body WFD classification.
Moderate (DMRB LA 109) (Ref 21-1)	<u>Geology</u> Partial loss of feature/designation, potentially adversely affecting integrity; partial loss of/ damage to key characteristics, features or elements.	Partial loss of features at a protected site i.e. SSSIs; NNRs.
	<u>Soils</u> Permanent loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource.)	N/A
	<u>Contamination</u> Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels) SP1010.	Significant contamination can be present. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use.
Moderate Adverse (DMRB LA 113) (Ref 21-3)	<u>Surface water:</u> relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification.
	<u>Groundwater:</u> relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250.

Magnitude	Criteria	Typical Examples
		<p>Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually.</p> <p>Partial loss of the integrity of GWDTE.</p> <p>Contribution to reduction in water body WFD classification.</p> <p>Damage to major structures through subsidence or similar effects or loss of minor structures.</p>
Moderate Beneficial (DMRB LA 113) (Ref 21-3)	<p><u>Surface water</u>: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).</p>	<p>HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition.</p> <p>Calculated reduction in existing spillage by 50% or more (when existing spillage risk $> 1\%$ annually).</p> <p>Contribution to improvement in water body WFD classification.</p>
	<p><u>Groundwater</u>: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).</p>	<p>Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $> 1\%$ annually).</p> <p>Contribution to improvement in water body WFD classification.</p> <p>Improvement in water body Catchment Abstraction Management Strategy ("CAMS") (or equivalent) classification.</p> <p>Support to significant improvements in damaged GWDTE.</p>
Minor (DMRB LA 109) (Ref 21-1)	<p><u>Geology</u></p> <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>Soils</u></p> <p>Temporary loss/ reduction of one or more soil function(s) and restriction to current or approved future use.</p> <p><u>Contamination</u></p> <p>Human health: contaminant concentrations are below relevant</p>	<p>Minor measurable change of features at Geological sites; i.e. RIGS.</p> <p>Through degradation, compaction or erosion of soil resource.</p> <p>Significant contamination is unlikely with a low risk to human health.</p>

Magnitude	Criteria	Typical Examples
	screening criteria (e.g. category 4 screening levels) SP1010.	Best practice measures can be required to minimise risks to human health.
Minor Adverse (DMRB LA 113) (Ref 21-3)	<u>Surface water</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on water supplies.
	<u>Groundwater</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Potential low risk of pollution. to groundwater from routine runoff - risk score < 150 Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on an aquifer, GWDTEs, abstractions and structures.
Minor Beneficial (DMRB LA 113) (Ref 21-3)	<u>Surface water</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).
	<u>Groundwater</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113 (Ref 21-3).	Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk $< 1\%$ annually). Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
Negligible (DMRB LA 109) (Ref 21-1)	<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.	Very minor change of features at sites of local importance, i.e. non-designated geological sites.
	<u>Soils</u>	N/A

Magnitude	Criteria	Typical Examples
	No discernible loss/ reduction of soil function(s) that restrict current or approved future use.	
	<u>Contamination</u> Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels) SP1010	No requirement for control measures to reduce risks to human health/ make land suitable for intended use.
Negligible (DMRB LA 113) (Ref 21-3)	<u>Surface water</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA113 (Ref 21-3).	No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.
	<u>Groundwater</u> : relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	No measurable impact upon an aquifer and/ or groundwater receptors and risk of pollution from spillages <0.5%.

21.4.7 The significance of effect matrix diverges from the generic significance evaluation matrix presented in **Chapter 5: EIA Process [TR030008/APP/6.2]**, and follows the guidance in DMRB LA 104 (Ref 21-4), as presented in **Table 21-5**.

Table 21-5: Significance Evaluation Matrix

		Magnitude of Impact				
		No change	Negligible	Minor	Moderate	Major
Sensitivity of Receptor	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Note: Where the significance of an effect is represented by two descriptors, for example large/very large within the matrix, professional judgement has been used to determine which of the significance descriptors applies to the effect being assessed.

- 21.4.8 Significant effects comprise those effects that are within the moderate, large or very large categories, in accordance with DMRB LA 104 (Ref 21-4).
- 21.4.9 The assessment of effect significance has taken into account the effectiveness of both embedded mitigation and standard mitigation measures, as these comprise measures that would be delivered as an integral component of the design of the Project and through the application of best practice construction techniques during its construction.
- 21.4.10 Where the assessment has identified that effects are significant after taking account of both embedded and standard mitigation measures, additional mitigation measures have been identified to reduce their significance (where possible) in line with the approach described in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.
- 21.4.11 A confidence level using a scale of Low-Medium-High has been included against each reported residual effect to reflect the confidence in the reported conclusions.

Limitations and Assumptions

- 21.4.12 The information presented in this chapter reflects that obtained and evaluated at the time of assessment and is based on the proposed parameters for the Project described in **Chapter 2: The Project [TR030008/APP/6.2]**, in accordance with the principles of the Rochdale Envelope.
- 21.4.13 The assessment has been undertaken with reference to the data, information and records pertaining to the baseline environment (derived from desk-based sources). As the assessment relies to an extent on the interpretation of third-party data and reports, it has been assumed that such information is accurate and a true reflection of the conditions it describes.
- 21.4.14 Site-based surveys comprising Ground Investigations and an ALC survey have been carried out at locations within the Site Boundary:
- a. At the time of carrying out the ALC survey, access was only possible to the western part of the arable field forming the Laporte Road Temporary Construction Area (Work No.9). For the purposes of carrying out the assessment, it has been assumed that the eastern part of this arable field would be classed in the same way (i.e. as Grade 3b) based on the assumption that the field in its entirety is being farmed in the same way. Further details of the ALC survey are presented in **Appendix 21.A [TR30008/APP/6.4]**.
 - b. A Ground Investigation has been undertaken to assess the presence of contamination at the Site and determine the impacts this may have on Site users and the environment, the findings of which have been used to inform the identification of appropriate standard mitigation measures (for example remediation). If, during development, any previously unidentified contamination is encountered, an appropriate investigation to allow sampling and testing of materials and risk assessment will be undertaken. Any actions resulting from the risk assessment will be agreed with the local planning authority along with any remedial measures in consultation with the

Environment Agency, where risks to controlled waters are identified. The Outline Remediation Strategy (**Appendix 21.C [TR030008/APP/6.4]**) sets out steps that would be undertaken where previously unidentified contamination is discovered. Any actions required will be agreed with the planning authority and Environment Agency.

21.5 Study Area

- 21.5.1 Based on the types of receptor that could potentially be affected by the Project and the geographical area over which potential direct and indirect impacts could occur, the following study areas have been adopted in the assessment. Their definition has been informed by a combination of professional judgement, established industry practice and a review of the areas originally defined at the scoping stage (as described in **Appendix 1.A [TR030008/APP/6.4]**): The study area for the majority of the assessment has been defined as the entirety of the land within the Site Boundary, along with a buffer extending 500m around this area to identify potential off-site sources of contamination and land stability issues. This includes any artificial land, geological deposits underlying artificial ground and any natural ground underlying surface water bodies (defined as the '500m study area').
- b. For the assessment of effects to controlled waters (including groundwater abstractions and groundwater SPZs), a larger buffer including and extending outward by 1km from the Site Boundary has been applied to enable consideration of possible migration pathways over longer distances (defined as the '1km study area').
 - c. For the assessment of agricultural soils, the study area has focused on existing land within the Site Boundary only. The ALC survey comprised evaluation of two parcels of mostly agricultural land, Works No.s 7 and 9, located to the west and east of the Site. The land within Works No.7 is former agricultural fields which have been abandoned and is currently zoned for light industrial use, for which there is an extant planning permission.
 - d. For the Ground Investigation, the area of investigation comprised Work No.s 3 East Site- Storage, 4 Laporte Road Culvert, 5 East Site – Hydrogen Production, 6 Pipeline Corridor and 7 West Site.
- 21.5.2 The extents of the Site Boundary are shown on **Figure 1.1** and **Figure 2.3 [TR030008/APP/6.3]**.

21.6 Baseline Conditions

Current Baseline

Data and Information Sources

- 21.6.1 The current baseline conditions within the adopted study areas of 500m and 1km have been identified within the assessment using data within published material and records from a range of sources, and environmental information gathered through Site surveys, as summarised in **Table 21-6**.

Table 21-6: Data and Information Sources

Topic	Data Source
Geological Data	British Geological Survey GeolIndex Online (Ref 21-15) British Geological Survey Solid and Drift for Partington (Sheet 81 (and including parts of Sheet 82 and 90) 1:50,000 (Ref 21-6) British Geological Survey Lexicon of Named Rock Units (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10)
Soils and Agricultural Land	Cranfield Soil and Agrifood Institute Soilscales (Ref 21-11) Provisional Agricultural Land Classification Grade map on the Department for the Environment, Food and Rural Affairs (Defra) Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref 21-13) ALC Survey reported in Appendix 21.A Agricultural Land Classification Survey Report [TR030008/APP/6.4]
Coal Mining	Coal Authority Interactive Map Viewer (Ref 21-12)
Environmental and Groundwater Data	Data and records held on the MAGIC website (Ref 21-13) Groundsure Report Enviro+Geo Insight Report (GS-9009838) (Ref 21-16)
Surface Water	Environment Agency (“EA”) Catchment Data Explorer (Ref 21-14)
Historic and Current Land Uses	Google Maps website (Ref 21-15)
Geotechnical Desk Studies and Risk Assessments	Immingham Green Energy Terminal Phase 1 Geo-environmental and Geotechnical Desk Study (AECOM, 2022) (Ref 21-63) AECOM. (2022). Immingham NH3 Import Terminal. Development Appraisal Report (Ref 21-17)
Ground Investigations	Geotechnical Engineering Limited (supervised by AECOM) at the East Site and West Site (Work No.s 3, 4, 5 and 7) from November 2022 to February 2023 (Ref 21-70) RSK Ground Investigation undertaken in 2020 within the Pipeline Corridor and Queens Road Temporary Construction Area (Work No.s 6, 7 and 8) - RSK (2020) Immingham BCP Phase 2 Geo-environmental and Geotechnical Site Investigation (Ref 21-18)

Statutory and Non-Statutory Designed Sites and Features

21.6.2 Based on the designation, the following statutory and non-statutory designated sites are located within and/or surrounding the Site Boundary, as defined by the 500m study area:

- a. The north-eastern extents of the Site within the marine environment are located within the Humber Estuary, which is designated as a Ramsar site; a SSSI; a SAC; and a SPA.

- b. The Site is located within a SSSI Impact Risk Zone, and the bank of the Humber Estuary within the Site is classified as ‘unfavourable – recovering’, based on information contained within the Groundsure Report (GS-9009838) (Ref 21-16).
- c. The Site is located within a Nitrate Vulnerable Zone associated with the North Beck Drain, as shown on **Figure 21.3 [TR030008/APP/6.3]**.

21.6.3 No designated sites of international, national or local geological conservation importance are located inside, or within 500m of, the Site.

21.6.4 There are no geological faults recorded inside, or within 500m of, the Site.

Soils and Agricultural Land Classification

21.6.5 Data held in the Cranfield Soils (Ref 21-11) describes the soils beneath the Site as “loamy and clayey soils of coastal flats with naturally high groundwater”, with naturally wet drainage and lime rich to moderate fertility, and notes that the “water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to the land”.

21.6.6 The BGS Estimated Background Soil Chemistry for the Site is recorded as the following, based on information contained within the Groundsure Report (GS-9009838) (Ref 21-16):

- a. Arsenic 15-25mg/kg
- b. Lead 100mg/kg
- c. Cadmium 1.8mg/kg
- d. Chromium 90-120mg/kg
- e. Nickel 30-45mg/kg

21.6.7 Using the ALC system, agricultural land in England is graded between 1 and 5 (depending on the extent to which physical or chemical characteristics impose long-term limitations on agricultural use):

- a. Grade 1 land is excellent quality agricultural land with very minor or no limitations to agricultural use.
- b. Grade 2 is very good quality agricultural land, with minor limitations which affect crop yield, cultivations or harvesting.
- c. Grade 3 land has moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield, and is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land).
- d. Grade 4 land is poor quality agricultural land with severe limitations which significantly restrict the range of crops and/or level of yields.
- e. Grade 5 is very poor quality land, with very severe limitations which restrict use to permanent pasture or rough grazing.

21.6.8 Land which is classified as Grades 1, 2 and 3a in the ALC system is defined as BMV agricultural land.

21.6.9 The ALC gradings for the Site are summarised in **Table 21-7**. The gradings have been established based on a combination of information within the Provisional Agricultural Land Classification Grade map (Ref 21-13) and the findings of the ALC survey reported in **Appendix 21.A [TR030008/APP/6.4]**.

Table 21-7: Summary of ALC Gradings for the Site

Location	ALC Grade (Ref 21-13)	ALC Survey Results
East Site (Work No. 3, 4, 5)	The East Site is designated as Grade Urban.	No survey undertaken.
West Site (Work No. 7).	Most of the West Site is designated as Grade 3. The land has not been subdivided into Grades 3a or 3b. A small area of land parallel to and including the properties on Queens Road is designated as Grade Urban	The ALC Survey indicates the West Site is designated as Grade 3b. However, Works No.7 is no longer farmed and is currently zoned for light industrial use, for which there is an extant planning permission.
Pipeline Corridor, Jetty Access and Pipe-Rack Corridor and Queens Road Temporary Construction Area (Work No. 2, 6 and 8)	The Pipeline Corridor and Jetty Access Road Corridor are designated as Grade Urban.	No survey undertaken.
Laporte Road Temporary Construction Area (Work No. 9)	The eastern half of the Laporte Road Temporary Construction Area is designated as Grade 3, but not subdivided into Grades 3a or 3b, and the western half is designated as Grade Urban	The ALC Survey within the thin strip of land in the Laporte Road Temporary Construction Area, adjacent to the Jetty Access and Pipe-Rack Corridor, indicates the land is classified as Grade 3b.
Temporary removal of Kings Road street furniture and overhead cables (Work No.10)	Kings Road is designated as Grade Urban	No survey undertaken

Geology

21.6.10 The geology beneath the Site is shown on the BGS GeoIndex (Onshore) Map (Ref 21-1), BGS 1:50,000 Sheet 81 (and including parts of Sheets 82 and 90) (Partington) (Ref 21-6) and on the 1:50,000 Geology Maps provided as part of the Groundsure Report (GS-9009838) (Ref 21-16).

21.6.11 **Table 21-8** provides a detailed summary of the anticipated geology beneath the Site and a summary of the description provided on the BGS Lexicon of Named Rock Units (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10). **Figures 21.1 and 21.2 [TR030008/APP/6.3]** illustrate the geology beneath the Site.

Table 21-8: Published Geology

Stratum		Expected Location	Description (BGS Lexicon) (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10)
Artificial	Made Ground (Undivided) Artificial Deposit	Made Ground (Undivided) is shown on the BGS GeoIndex in the western half of the East Site (Work No. 3, 3-A, 4, 5 and 5-A) and in the central area of the Pipeline Corridor (Work No. 6). Although it is not mapped across most of the Site, Made Ground is anticipated to be present across the majority of the Site.	Made Ground is described as “an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified. Variable composition”.
Superficial Deposits	Beach and Tidal Flat Deposits (Clay, Silt and Sand)	Northeastern boundary of the Site (Jetty Access and Pipe-Rack Corridor and Laporte Road Temporary Construction Area in the northeast) of the Site (Work No. 2 and 9), along the bank of the Humber Estuary.	Beach and Tidal Flat Deposits are described as “composite of ‘Beach deposits’: Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks, and ‘Tidal Flat Deposits’: commonly silt and clay with sand and gravel layers; possible peat layers; from the tidal zone”.
	Tidal Flat Deposits (Clay and Silt)	Entire Site, apart from the bank of the Humber Estuary.	Tidal Flat Deposits are described as “unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat”.
	Devensian Till (Diamicton)	Entire Site, underlying the Tidal Flat Deposits.	There is no description on the BGS Lexicon of Named Rock Units. Till usually comprises clay, sand, gravel and boulders.
Bedrock	Flamborough Chalk Formation	The BGS GeoIndex (Ref 21-5) indicates the Flamborough Chalk Formation is present beneath most of the Site at Work No’s 3, 5, 6, 8 and 9, underlying the Devensian Till. However, the BGS Sheet 81 for Patrington 1:50,000 Map (Ref 21-6) indicates that the Flamborough Chalk Formation is present across most of the Site, apart from a thin strip along the western boundary of the West Site (Work No. 7).	The Flamborough Chalk Formation is described as “White, well-bedded, flint-free chalk with common marl seams (typically about one per metre). Common stylolitic surfaces and pyrite nodules”.

Stratum		Expected Location	Description (BGS Lexicon) (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10)
	Burnham Chalk Formation	The Burnham Chalk Formation underlies the Flamborough Chalk Formation across the entire Site and underlies the western boundary of the West Site (Work No.7). Kings Road Work No.10 is underlain by the Burnham Chalk Formation.	The Burnham Chalk Formation is described as “white, thinly-bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams”.

21.6.12 The Groundsure Report (GS-9009838) (Ref 21-16) indicates the minimum permeability of the superficial deposits is very low, and the maximum permeability varies between low and moderate. The moderate permeability may be associated with the Beach and Tidal Flat Deposits, although this has not been confirmed. The pattern of groundwater flow in the superficial deposits is recorded as intergranular. The minimum and maximum permeability of the chalk bedrock is designated as very high, although the range of permeability may vary by one or two orders of magnitude. The groundwater flow pattern is recorded as being via fractures which is commonly considered to result from the presence of a network of interconnected joints and fissures in the chalk strata.

21.6.13 There are seventeen BGS boreholes located inside, and within 5m of, the Site Boundary. Of the seventeen BGS boreholes, fourteen had accessible borehole records: TA11SE152, TA11SE151, TA21SW278, TA21SW91, TA21NW16, TA21NW18, TA21NW17, TA21NW20, TA21NW3/C, TA21NW3/A, TA21NW3/D, TA21SW338, TA11SE32 and TA21SW92. A summary of the geology encountered within these BGS boreholes is provided in **Table 21-9**.

Table 21-9: Summary of encountered strata in BGS boreholes

Strata	Minimum Depth (m below ground level (bgl))	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater Strikes (m bgl)
West Site (Work No. 7)				
Soil	0.0	0.3	0.3	-
Clay	0.0	15.24	1.5** – 6.5**	-
Warp	0.3	6.4	4.88 – 6.1	-
Peat	2.9	7.62	0.1 – 1.22	-
Silt	7.62	15.09	0.15 – 0.61	-
Gravel	5.18	5.79	0.61*	-
Boulder Clay	7.77	18	2.89 – 7.17	-

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Strata	Minimum Depth (m below ground level (bgl))	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater Strikes (m bgl)
Sand	10.97	11.58	0.61*	-
Chalk***	15.24	25.3**	3.28** – 4.88**	-
Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8)				
Soil	0	1.6	1.3 – 1.6	-
Silt	0	7.92	2.75*	-
Warp	0	9.14	7.16 – 9.14	-
Clay	1.3	19.6	10.37 – 18.3	A water strike was recorded at 16.5m bgl in TA21NW17.
Peat	7.16	7.92	0.46 – 0.6	-
Marl	7.62	20.42	12.8*	-
Clay and Marl	20.42	27.43	7.01	-
Clay and Silt	16.8	18.6	1.8*	-
Gravel	17.1	22.6	3 – 4.3	A water strike was recorded at 18.6m bgl in TA21NW17.
Chalk***	16.46	32.6**	4.9** – 10.8**	-
East Site (Work No. 3, 4, 5)				
Warp	0	9.14	8.84 – 9.14	The rest level of groundwater was recorded at the ground surface in TA21NW3/D.
Silt	0	10.96**	0.42 – 8.06	-
Sand	8.06	18.59	0.05 – 0.61	-
Peat	8.84	9.83	0.09 – 0.61	-
Clay	9.14	20.12	1.22 – 10.37	-
Chalk***	19.51	33.83	10.97** - 13.71**	-

Strata	Minimum Depth (m below ground level (bgl))	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater Strikes (m bgl)
Laporte Road Temporary Construction Area* (Work No. 9)				
Warp	0	8.84	8.84	-
Peat	8.84	9.14	0.3	-
Boulder Clay	9.14	18.9	1.53 – 7.62	-
Sand	16.76	17.37	0.61	-
Gravel	18.9	21.03	2.13	-
Clay	21.03	25.3	4.27	-
Chalk	25.3	31.4**	6.1**	-
<p>*Only encountered in one borehole **Depth to base not proven ***The handwriting on the borehole logs was not clear for Chalk stratum. The handwriting may allude to 'Chalk Bearings' which are referred to in the BGS Chalk Aquifer System of Lincolnshire Research Report (Ref 21-30), however, this is not clear. This summary has been included within Chalk. ****The borehole log only stated 'Bd'. The strata cannot be determined but is likely to relate to boulder clay based on the published geological maps and nearby boreholes.</p>				

Ground Stability Hazards

- 21.6.14 The Groundsure Report (GS-9009838) (Ref 21-16) presents information on the ground stability hazards at the Site.
- 21.6.15 The Tidal Flat Deposits on the Site are associated with a Low shrink swell clay ground stability hazard. The Beach and Tidal Flat Deposits on the banks of the Humber Estuary within the Site Boundary are associated with a *Very Low* shrink swell clay ground stability hazard.
- 21.6.16 The areas of the Site that are mapped as Made Ground on the BGS 1:50,000 Artificial Map (Ref 21-5) are associated with a *Very Low* running sands and compressible ground stability hazards, and the remaining areas of the Site are classified as a *Moderate* hazard.
- 21.6.17 The Site has been classified as a *Negligible* risk for collapsible ground stability hazards and ground dissolution hazards, and has been classified as a *Very Low* risk associated with landslide ground stability hazards.

Ground Investigations

- 21.6.18 To establish the baseline and inform the design and ground assessment for the Project, three Ground Investigations ("GIs") have been undertaken. The first Ground Investigation delivered in 2020 by RSK, was carried out within the Pipeline Corridor and Queens Road Temporary Construction Area (Works No.s 6, 7 and 8). A second Ground Investigation was undertaken from November 2022

to March 2023, by Geotechnical Engineering Limited (supervised by AECOM). The purpose of this Ground Investigation was to assess the ground to inform design at the West Site and East Site (Works No.s 3,4,5 and 7). The third Ground Investigation was undertaken along the Pipeline Corridor (Works No. 6) from May 2023 to June 2023 by Geotechnical Engineering Limited. Ground Investigations are scheduled to take place in the Pipe Rack and Jetty Access Road (Work No. 2) in Q4 2023

- 21.6.19 Ground Investigations covering the Pipeline Corridor (Work No. 6), Pipe Rack and Jetty Access Road (Work No. 2) are ongoing and the data from these investigations was not available for inclusion. The assessment presented in this chapter therefore makes realistic worst-case assumptions about the likely material present in these areas.

Geotechnical Engineering Limited: Ground Investigation November 2022 to February 2023

- 21.6.20 A Ground Investigation was undertaken by Geotechnical Engineering Limited (supervised by AECOM) in the West Site (Work No. 7) and East Site (Work No. 3, 3-A, 4, 5 and 5-A) between 8 November 2022 and 16 February 2023.
- 21.6.21 The purpose of this investigation was to inform the design of the Project, and information gathered has been used to assist the establishment of baseline conditions at the Site and to inform the assessment of the Project's impacts and effects. This has included chemical and geotechnical data (via site and laboratory testing) from across the Site, to be able to develop a Conceptual Site Model (CSM) and provide adequate, good quality data for undertaking human health, controlled waters and ground gas risk assessments.
- 21.6.22 The findings of this Ground Investigation, including the CSM, are provided in **Appendix 21.B [TR030008/APP/6.4]**.
- 21.6.23 A summary of the strata encountered within the West Site (Work No. 7) during the ground investigation is presented in **Table 21-10**.

Table 21-10: Strata encountered at Work No. 7

Strata	Depth Encountered	Thickness Range
Topsoil	Ground level	01m to 0.6m
Made Ground	Ground Level	0.25m to 2.1m
Firm Tidal Flat Deposits	Between 0.15m bgl and 1.3m bgl	0.2m to 2.5m
Tidal Flat Deposits	Between 0.25m bgl and 10m bgl	0.4m to 11.7m
Glacial Till Deposits	Between 4.2m bgl and 10.6m bgl	6.5m to 17.6m
Granular Till Deposits	Between 12.5m bgl and 18.72m bgl	0.1m to 2.62m
Weathered Flamborough Chalk	Between 18.4m bgl and 22.5m bgl	0.46m to 8.9m

Strata	Depth Encountered	Thickness Range
Flamborough Chalk	Between 23.16m bgl and 30.65m bgl	0.85m and 4m (proven)

21.6.24 A summary of the strata encountered within the East Site Hydrogen Production Site (Work No. 5 and 5-A) is presented in **Table 21-11**.

Table 21-11: Strata encountered at Work No. 5 and 5A

Strata	Depth Encountered	Thickness Range
Made Ground	Ground Level	0.35m to 4m
Firm Tidal Flat Deposits	Between 0.4m bgl and 3m bgl	Up to 2.3m
Tidal Flat Deposits	Between 1.2m bgl and 4.6m bgl	0.3m to 11.4m
Glacial Till Deposits	Between 6.14m bgl and 14.2m bgl	5.3m to 14.15m
Granular Glacier Till Deposits	Between 15.4m bgl and 20.8m bgl	0.12m to 3.4m
Weathered Flamborough Chalk	Between 23.35m bgl and 27.75m bgl	0.25m to 4.6m
Flamborough Chalk	Between 23.16m bgl and 30.65m bgl	0.85m and 4m (proven)

21.6.25 A summary of the strata encountered in the East Site Ammonia Storage Site (Work No. 3, 3A) and Laporte Road Culvert (Work No. 4) is presented in **Table 21-12**.

Table 21-12: Strata encountered at Work No's. 3, 3A and 4

Strata	Depth Encountered	Thickness Range
Made Ground	Ground Level	0.25m to 4m
Firm Tidal Flat Deposits	Between 0.3m bgl and 1.2m bgl	Up to 2.1m
Tidal Flat Deposits	Between 0.3m bgl and 1.2m bgl	8.4m to 12.2m
Glacial Till Deposits	Between 9.9m bgl and 13.1m bgl	4.98m to 11.06m
Granular Glacier Till Deposits	Between 16.76.4m bgl and 22.5m bgl	0.85m to 4.8m
Weathered Flamborough Chalk	Between 20.25m bgl and 25m bgl	1.15m to 3.75m
Flamborough Chalk	Between 23.3m bgl and 26.15m bgl	7.65m and 29.35 (proven)

21.6.26 The groundwater level monitoring data indicates that groundwater is present in all geological units beneath the Site. Perched groundwater was encountered within Made Ground, mostly within the East Site. No monitoring boreholes were installed within Made Ground in the West Site. Two boreholes were scheduled to be installed within Made Ground – W-BH26 and W-BH31. However, due to

shallow depths of Made Ground at these two locations (0.4m bgl and 0.30m bgl respectively) it was not possible to install monitoring boreholes into Made Ground. Groundwater levels within Made Ground varied between ground level and 2.5m bgl. The groundwater levels in boreholes screened within Tidal Flat Deposits within the East Site varied between 33.97m AOD to 1.63m OD. Groundwater levels within Glacial Till Deposits varied between 0.5m OD and 1.06m OD in the West Site and 1.82m OD and 2.65m OD in the East Site. Groundwater levels within monitoring wells within the Flamborough Chalk Formation varied between 0.72m OD and 3.1m OD in the East Site. All nine Chalk monitoring boreholes installed recorded artesian conditions during the monitoring period, except W-BH17 which recorded slightly lower levels (up to 1.46m bgl) on two occasions. The groundwater generally flows in a north-easterly direction towards the Humber Estuary.

- 21.6.27 In relation to asbestos, Chrysotile was identified in samples of Made Ground in E-BH10 (East Site Storage Tank site (Work No. 3 and 3-A)) and E-BH25 (East Site Hydrogen Production site (Work No. 5 and 5-A)) at ground level. The sample from E-BH10 was subjected to quantification testing and returned an asbestos concentration of <0.001 w/w %.
- 21.6.28 No exceedances of the human health Generic Assessment Criteria (“GAC”) were identified within soil samples. The results from the Hazard Quotient Assessment indicated a low risk associated with the cumulative toxicological effects from the combined Total Petroleum Hydrocarbon (“TPH”) species. No exceedances of the construction worker Acute Evaluation Criteria (“AEC”) were identified for soil samples.
- 21.6.29 Two rounds of surface water sampling were undertaken on 31st March 2023 and 18 May 2023 from Habrough Marsh Drain and North Beck Drain. Exceedances of the EQS were recorded for Polycyclic Aromatic Hydrocarbons (“PAHs”), metals and inorganics. Overall, it is considered that the exceedances are indicative of wider contamination within nearby surface watercourses associated with the historical and current industrial land use within Immingham. Elevated concentrations of metals were also recorded within groundwater and soil leachate samples, which may indicate natural elevated metal concentrations in the area.
- 21.6.30 Exceedances of the EQS Coastal criteria were recorded within soil leachate, surface water and groundwater samples for chloroform, PAHs, metals and inorganics. Most exceedances were recorded within the same order of magnitude or one order of magnitude above the EQS Coastal criteria. However, a single exceedance of cyanide was recorded at two orders of magnitude above the EQS Coastal criteria. Exceedances of ammoniacal nitrogen were recorded four orders of magnitude above the EQS Coastal criteria in Made Ground (870mg/l) and three orders of magnitude above the EQS in Tidal Flat Deposits (9.4mg/l). Exceedances of ammonium were recorded up to five orders of magnitude above the EQS in Made Ground (1,100mg/l) and three orders above the magnitude in Tidal Flat Deposits (12mg/l). The highest concentrations were recorded within E-BH15 within the East Site – Hydrogen Production area which coincides with an ammonia odour detected during the Ground Investigation within Made Ground in

E-BH14A and E-BH15. This suggests a potential localised source of ammoniacal nitrogen within Made Ground. Overall, it is considered that there may be a potential risk to the Humber Estuary associated with ammonium and ammoniacal nitrogen in groundwater. It is also noted that the ground investigation did not identify gross contamination or evidence of a major spillage. As a result, the determinands exceeding the EQS may be associated with an amalgamation of nearby industrial activity in the area.

- 21.6.31 Exceedances of the Drinking Water Standard (“DWS”) were recorded within soil leachate and groundwater samples for hydrocarbons, PAHs, metals and inorganics in the East Site (Work No. 3, 4 and 5). An isolated and marginal exceedance of naphthalene and C12-C16 aromatics was recorded within groundwater in Made Ground and Tidal Flat Deposits respectively. Most exceedances of the DWS were recorded within the same order of magnitude or one order of magnitude above the DWS. However, concentrations of ammonium in E-BH15 (1,100mg/l) are four orders of magnitude above the DWS (0.5mg/l) within Made Ground in E-BH15. Furthermore, the concentration of nitrate in E-BH15 (1,660mg/l) is two orders of magnitude above the DWS (50mg/l). This coincides with boreholes which identified an ammonia odour during the GI. Concentrations of sodium (16,000mg/l) and chloride (3,700mg/l) were recorded in Tidal Flat Deposits groundwater up to two orders of magnitude and one order of magnitude above the DWS criteria (200mg/l and 250mg/l respectively) within the East Site. Overall, it is considered that inorganics and metals may pose a risk to groundwater quality in the East Site. No exceedances of the DWS were recorded in the West Site (Work No. 7). Therefore, there is not considered to be a risk to groundwater quality in the West Site (Work No. 7). In order to further understand any temporal trends in contaminants, additional groundwater monitoring is ongoing, but the additional data, which will be submitted into the examination at the appropriate time, are not expected to change the conclusions of the assessment presented in this chapter, which is based on a ‘realistic worst case’ approach.
- 21.6.32 The results of the ground gas monitoring indicated the Site is classified as Characteristic Situation (“CS”) 5 due to concentrations of methane up to 93.9% (v/v), carbon dioxide concentrations of up to 5.9 % (v/v) and a maximum flow rate of 120l/hr. However, it should be noted that the assessment assumes the worst case ground gas conditions by using the maximum recorded gas concentrations and maximum recorded flow rates. Based on the results of the investigation and the geology of the Site, the sources of high methane concentrations are not clear. The methane concentrations were also variable at the same monitoring location throughout the monitoring rounds. It should also be noted that most standpipes were flooded which may have caused compression of gases and hence affect the concentrations recorded. Therefore, the classification of CS5 may be an overestimate of the ground gas conditions. Due to the uncertainty associated with the gas results, an additional assessment was undertaken using the Total Organic Carbon (“TOC”) results in line with CL:AIRE ‘A Pragmatic approach to Ground Gas Risk Assessment’ (Ref 21-66) which indicates a classification of CS2. Additional ground gas monitoring is being undertaken to further confirm the gas and flow rate regime. Gas sampling and laboratory

analysis will also be undertaken to identify the potential source of the gas and validate the monitoring results obtained to date. The additional data, which will be submitted into the examination at the appropriate time, are not expected to change the conclusions of the assessment presented in this chapter, which is based on a ‘realistic worst case’ approach.

21.6.33 BRE Special Digest 1 testing was undertaken on 165 samples for the West Site and East Site (Storage Tank and Hydrogen Production Sites) to determine the Design Sulphate (“DS”) and Aggressive Chemical Environment for Concrete (“ACEC”) classifications. The findings of which are provided in **Table 21-13**.

Table 21-13. Summary of BRE Test Results

Strata	East Site (Hydrogen Production site) (Work No. 5)		East Site (Storage Tank site) (Work No. 3)		West Site (Work No. 7)	
	DS Class	ACEC Class	DS Class	ACEC Class	DS Class	ACEC Class
Made Ground	DS – 4	AC – 4	DS – 4	AC – 4	DS – 4	AC – 3s
Tidal Flat Deposits	DS – 4	AC – 3s	DS – 4	AC – 3s	DS – 4	AC – 3s
Glacial Till Deposits	DS – 3	AC – 2s	DS – 4	AC – 3s	DS – 4	AC – 3s
Granular Glacial Till Deposits	DS – 2	AC – 2	DS – 1	AC – 1	DS – 4	AC – 4
Flamborough Chalk Formation	DS – 1	AC – 1	DS – 1	AC – 1	DS – 2	AC – 2

RSK: Ground Investigation

21.6.34 A Ground Investigation was undertaken in the Pipeline Corridor area (Work No. 6) in November 2020 by RSK (Ref 21-18) and related to development proposals which comprised of a cold fridge store, two-storey modular office unit, heavy goods vehicle (“HGV”) parking facilities, dock levellers and a services compound.

21.6.35 The investigation comprised seven boreholes between 5m bgl and 30.45m bgl and twelve trial pits between 2.6m bgl and 4m bgl. Six rounds of groundwater and ground gas monitoring were undertaken as part of the investigation, with chemical and geotechnical laboratory analysis also undertaken. The location of the exploratory holes is shown in **Figure 21.8 [TR030008/APP/6.3]**.

21.6.36 In summary, the strata encountered is presented in **Table 21-14**

Table 21-14: Strata encountered during the RSK Ground Investigation

Strata	Depth Encountered	Thickness Range	Description
Topsoil	Ground level	0.1m	N/A
Made Ground	Ground level	0.1m to 2.4m	The Made Ground deposits were described as “soft slightly sandy gravelly clays with occasional to frequent cobbles”. However, it is also noted that pockets or discrete bands of granular “clayey slightly cobble or slightly sandy gravels” were also encountered. Anthropogenic material recorded in Made Ground included metal, asphalt, rebar, ash, timber, wood, concrete, brick and boulders of reinforced concrete which may be associated with former foundations or pile caps;
Tidal Flat Deposits	Between 7.9m and 8.3m	7.9m to 8.3m	The Tidal Flat Deposits were described as “soft or soft to firm grey and grey brown clay” underlain by ‘very soft dark blueish grey silty clays, generally with a frequent organic odour and some organic content’. It is noted that the Tidal Flat Deposits become very soft from approximately 9m bgl. Small bands of dry peat were encountered between 9.5m bgl and 9.7m bgl, and 10m bgl and 10.4m bgl in BH01;
Glacial Till Deposits	Between 9.4m bgl and 10.7m bgl	11.3m to 14.0m	The Glacial Till was described as “firm slightly sandy slightly gravelly slightly silty clays which became stiff with depth”. The gravel comprised of flint gravel, fine to medium chalk and occasional coarse chalk. BH01 recorded a grey and buff silty with flint and chalk gravel overlying the chalk bedrock
Flamborough Chalk	Between 22m bgl to 23.5m bgl for Grade Dm and 22.5m bgl to 25m bgl for Grade Dc. The depth to the base of the chalk was not proven.	A proven thickness between 0.5m and 1.5m for Grade Dm and a proven thickness of 5m to 7.9m for Grade Dc	Chalk is classified based on the engineering behaviour using the classification system defined in CIRIA C574 ‘Engineering in Chalk’ (Ref 21-61). Grade Dm chalk is defined as chalk where “the material will behave as a cohesive fine soil” with >35% comminuted chalk matrix and approximately <65% coarser fragments (Ref 21-61). Grade Dc chalk is described as “where clasts (intact chalk lumps) dominate”, resulting in the material behaving as “a granular, coarse soil” (Ref 21-61). There is approximately <35%

Strata	Depth Encountered	Thickness Range	Description
			<p>communicated chalk matrix and >65% coarser fragments for Grade Dc.</p> <p>Grade Dm chalk was described as “a cream and white slightly sandy slightly gravelly silt” with weak gravel that had orangish brown weathering. The Grade Dc chalk was described as “white and occasionally cream silty gravel and cobbles of weak chalk, with some white and occasionally creamish grey silty matrix” with speckled gravel and cobbles with some orange, brown staining.</p>

21.6.37 The Immingham BCP Phase 2 Geo-environmental and Geotechnical Site Investigation report (Ref 21-18) noted that there were generally no signs of soil contamination across the Site. Hydrocarbon odours were noted between 1.7m bgl and 2.4m bgl within Made Ground in BH01. Organic odours were observed within Made Ground and Tidal Flat Deposits, and an occasional sulphurous odour was noted within Tidal Flat Deposits.

21.6.38 Perched groundwater was encountered at the base of Made Ground deposits. Groundwater strikes were recorded between 16m bgl and 18.3m bgl in two boreholes, rising to between 12m bgl and 14.9m bgl after twenty minutes. Groundwater seepages were recorded between 1.7m bgl and 4m bgl. A summary is provided in **Table 21-15**.

Table 21-15: Summary of groundwater strikes and seepages in the 2020 Ground Investigation of the Pipeline Corridor area (Work No. 6)

Exploratory Hole	Depth	Strata
Groundwater Strikes		
BH01	16m bgl (initial strike) 12m bgl (after 20 minutes) 3.5m bgl (borehole completion)	Sand and Gravel within the Glacial Till at 16m bgl. Blowing sands were recorded at this depth.
BH02	18.3m bgl (initial strike) 14.9m bgl (after 20 minutes) 2.8m bgl (borehole completion)	Firm slightly gravelly silty clay within the Glacial Till at 18.3m bgl.
Groundwater Seepages		
WS01	3m bgl	Firm slightly gravelly silty clay within the Tidal Flat Deposits.
WS02	2m bgl	Firm slightly silty clay with the Tidal Flat Deposits.

Exploratory Hole	Depth	Strata
WS04	3.5m bgl	Firm slightly gravelly silty clay within the Tidal Flat Deposits.
WS05	2m bgl	Soft slightly gravelly slightly silty clay within the Tidal Flat Deposits. Noted as very soft and wet material at 2m bgl.
CBR02	3.4m bgl (trial pit terminated)	Very soft slightly gravelly slightly sandy silty clay within the Tidal Flat Deposits.
CBR03	1.7m bgl	Sandy angular to subangular fine to coarse gravel within Made Ground.
CBR04	3.6m bgl (trial pit terminated)	Firm silty clay within the Tidal Flat Deposits.
CBR05	3.2m bgl (trial pit terminated)	Very soft occasionally mottled silty clay within the Tidal Flat Deposits.
CBR06	3.2m bgl (trial pit terminated)	Firm and slightly friable mottled slightly gravelly silty clay within the Tidal Flat Deposits.
CBR07	3.5m bgl (trial pit terminated)	Firm grey silty clay within the Tidal Flat Deposits.
CBR08	3.8m bgl (trial pit terminated)	Soft to firm grey silty clay within the Tidal Flat Deposits.
CBR09	3.2m bgl (trial pit terminated)	Soft to firm grey silty clay within the Tidal Flat Deposits.
TP01	2.6m bgl (trial pit terminated)	Firm grey silty clay within the Tidal Flat Deposits.
TP02	4m bgl (trial pit terminated)	Soft to firm grey silty clay within the Tidal Flat Deposits

- 21.6.39 The depth to water was recorded as dry to 1.65m bgl within the Made Ground response zone. The monitoring wells with a response zone within the Flamborough Chalk Formation recorded depth to water between 1.53m bgl and 3.29m bgl.
- 21.6.40 The asbestos screening identified asbestos containing material in two out of six samples. Chrysotile loose fibres (<0.001% w/w) were detected in samples of Made Ground at 0.3m bgl and 0.5m bgl in WS05 and TP01, respectively. However, this is associated with past industrial use and the concentrations detected are not considered to present a significant risk.
- 21.6.41 Exceedances of DWS for nickel and selenium were recorded in two groundwater samples within two boreholes (BH01 and BH02). The exceedances were of the same order of magnitude as the DWS. There were no exceedances of nickel and selenium recorded in soil samples of Made Ground and Tidal Flat Deposits.

- 21.6.42 Exceedances of the GAC for coastal surface waters for nickel and zinc were recorded in two samples of groundwater within two boreholes (BH01 and BH02).
- 21.6.43 The results of the ground gas monitoring indicated the Pipeline Corridor Area is classified as Characteristic Situation (CS) 2 due to the concentrations of methane (7.6% and 11.4% within BH02).
- 21.6.44 The Waste Acceptance Criteria (“WAC”) results indicated that the waste required treatment and re-testing before disposal at a hazardous landfill.
- 21.6.45 Running sands were encountered within Glacial Till between depths of 16m bgl and 19m bgl.
- 21.6.46 Ten California Bearing Ratio (“CBR”) in situ tests were undertaken at the Site within Made Ground and Tidal Flat Deposits. Nine tests were completed on Made Ground samples. Of the nine tests completed, five were completed on Made Ground clay samples which had a minimum CBR value determined at or below anticipated formation level between 5.7% and 19%. Four tests were completed on Made Ground gravel samples which had a minimum CBR value determined at or below anticipated formation level between 2% and 13%. One test was completed within borehole CBR05 on Tidal Flat Deposits which had a minimum CBR value determined at or below anticipated formation level of 3.6%. The sub-grade condition at the time of construction should be confirmed and tested at the final formation level. The results indicate that sub-grade soils are frost susceptible.
- 21.6.47 Ten samples were tested to determine the BRE Sulphate Classification (Ref 21-18). For the purposes of the assessment, the Site was classified as brownfield ground likely to contain pyrite. The BRE test results were recorded as follows:
- DS class DS-1 and Aggressive Classification (“AC”) Class AC-1 for water soluble sulphate in Made Ground.
 - DS class DS-2 and AC Class AC-2 for total potential sulphate in Made Ground.
 - DS class DS-2 and AC Class AC-2 for water soluble sulphate in Tidal Flat Deposits.
 - DS class DS-5 and AC class AC-5 for total potential sulphate in Tidal Flat Deposits.
 - Overall, the DS class is recommended as DS-2 and the ACEC classification is recommended as AC-2.
- 21.6.48 The Immingham BCP Phase 2 Geo-environmental and Geotechnical Site Investigation report (Ref 21-18) concluded that there are no significant contaminant risks with regards to human health and controlled waters receptors, and also noted that the Made Ground and Tidal Flat Deposits are of a variable nature, highly compressible and of low strength.

Coal Mining

- 21.6.49 The Coal Authority Interactive Viewer (Ref 21-12) indicates the landside infrastructure areas within the Site are not within a Coal Mining Reporting Area or within a Development High Risk Area.
- 21.6.50 The information does, however, identify the Humber Estuary as designated as a Coal Mining Reporting Area and the marine infrastructure areas therefore lie within an area which may contain unrecorded coal mining related hazards.

Hydrogeology

- 21.6.51 A summary of the hydrogeological conditions for the Site are provided in **Table 21-16**.

Table 21-16: Aquifer Designations

Strata	Location	Designation	Definition (Ref 21-19)
Beach and Tidal Flat Deposits	Northeastern boundary of the green hydrogen production facility (Jetty Access and Pipe-Rack Corridor and Laporte Road Temporary Construction Area in the northeast) of the Site (Work No. 2 and 9)	Secondary (Undifferentiated)	The EA describe Secondary (Undifferentiated Aquifers) as “ <i>aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value</i> ”.
Tidal Flat Deposits	Entire Site, apart from the bank of the Humber Estuary.	Unproductive Aquifer	The EA describe Unproductive Aquifers as “ <i>largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them</i> ”.
Flamborough Chalk Formation and Burnham Chalk Formation	The Flamborough Chalk Formation is present across most of the Site, apart from a thin strip along the western boundary of the West Site. The Burnham Chalk Formation underlies the Flamborough Chalk Formation across the entire Site and underlies the western boundary of the West Site. Kings Road Work No.10 is underlain by the Burnham Chalk Formation..	Principal	The EA describe Principal Aquifers as aquifers that “ <i>provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands</i> ”.

- 21.6.52 The Groundsure Report (GS-9009838) (Ref 21-16) indicates that the North Lincolnshire Chalk Unit (a WFD groundwater body) is located on the Site. The overall rating, chemical rating and quantitative rating (dated to 2019) are described as ‘poor’.

- 21.6.53 There are no Drinking Water Protected Areas (Surface Water) or Drinking Water Safeguard Zones (Groundwater) located within the Site.
- 21.6.54 The groundwater vulnerability map on Defra’s MAGIC Maps (Ref 21-13) and in the Groundsure Report (GS-9009838) (Ref 21-16) indicates that the West Site (Work No. 7), East Site (Work No. 3, 3-A, 4, 5 and 5-A), most of the Pipeline Corridor (Work No. 6), Queens Road Temporary Construction Area (Work No. 8) and the southern extent of the Pipe-Rack and Jetty Access Road (Work No.2) and Kings Road (Work No. 10) have a Low groundwater vulnerability. The EA (Ref 21-20) describe a Low groundwater vulnerability as “areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of low permeability superficial deposits”. The Low classification is derived from the combination of a productive bedrock aquifer and an unproductive superficial aquifer.
- 21.6.55 The Laporte Road Temporary Construction Area (Work No. 9), and the northeast area of the East Site – Hydrogen Production site (Work No. 5) and Pipe-Rack and Jetty Access Road (Work No. 2) are designated as Medium – High groundwater vulnerability on Defra’s MAGIC Maps (Ref 21-13) and as High vulnerability in the Groundsure Report (GS-9009838) (Ref 21-16). The EA (Ref 21-20) describes Medium groundwater vulnerability as “areas that offer some groundwater protection. Intermediate between high and low vulnerability” and High groundwater vulnerability as “areas able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability superficial deposits”. The high vulnerability is derived from the combination of a productive superficial (Secondary Undifferentiated Aquifer within the Beach and Tidal Flat Deposits) and a productive bedrock aquifer (Principal Aquifer within the Flamborough Chalk Formation). The high vulnerability is also related to the combination of a productive bedrock aquifer (Principal Aquifer within the Flamborough Chalk Formation) and an unproductive superficial aquifer (Tidal Flat Deposits) in the remaining areas of the Laporte Road Temporary Construction Area (Work No. 9) which are underlain by Tidal Flat Deposits and in turn Devensian Till deposits.
- 21.6.56 SPZs are located on the Site, as shown in **Figure 21.6 [TR030008/APP/6.3]**. An SPZ 1 (Inner Catchment) is located in the southern half of the Site within the Pipeline Corridor (Work No. 6), Queens Road Temporary Construction Area (Work No. 8) and West Site (Work No. 7), near Queens Road. The EA (Ref 21-21) describes an SPZ 1 as a “50 day travel time of pollutant to source with a 50m default minimum radius”. An SPZ 2 (Outer Catchment) radiates out from the SPZ 1 towards the south, and encompasses the southern half of the Site, including the West Site (Work No. 7), and further north within the proposed Pipeline Corridor (Work No. 6). The EA (Ref 21-21) describe an SPZ 2 as a “400 day travel time of pollutant to source. This has a 250 or 500m minimum radius around the source depending on the amount of water taken”. An SPZ 3 (Total Catchment) is located around the SPZ 2, and encompasses the remainder of the Site, including the Pipe-Rack and Jetty Access Road (Work No.2) East Site (Work No. 3, 3-A, 4, 5 and 5-A) and Laporte Road Temporary Construction Area (Work No. 9). The EA (Ref 21-21) describe an SPZ 3 as “the area around a supply source within which all the groundwater ends up at the abstraction point.

This is the point from where the water is taken. This could extend some distance from the source point". The SPZ is likely associated with an abstraction within the Flamborough Chalk Formation off-site due to the designation as a Principal Aquifer. The Chalk is overlain and confined by a considerable thickness of superficial strata which are themselves not productive aquifers.

- 21.6.57 An SPZ 2c (Outer Catchment within a Confined Aquifer) is also located on the Site, within the northern corner of the West Site (Work No. 7). It is noted in the Groundsure Report (GS-9009838) (Ref 21-16) that a "confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place". The SPZ 2c is likely to be associated with the Flamborough Chalk Formation.
- 21.6.58 There are no groundwater abstractions located within the Site Boundary. The closest groundwater abstraction is located 37m northwest from the West Site (Work No. 7) associated with a historical raw water supply abstraction. This groundwater abstraction is associated with the SPZ 1 within the Site Boundary.
- 21.6.59 In addition to the above abstraction, there are a further eight groundwater abstractions within 1km of the Site.
- 21.6.60 Of the nine groundwater abstractions, three are considered to be active abstractions and six are considered to be historical abstractions.

Surface Waters

- 21.6.61 The EA Catchment Data Explorer (Ref 21-14) and the Groundsure Report (GS-9009838) (Ref 21-16) indicate the entire Site is located within the catchment for the North Beck Drain water body. Its ecological classification (dated to 2019) is defined as 'moderate'. Its chemical classification (dated to 2019) is defined as 'fail' for priority hazardous substances Mercury and its Compounds and Polybrominated Diphenyl Ethers ("PDBE"). The water body is also described as 'heavily modified'. The North Beck Drain is located immediately adjacent to the eastern Site Boundary in the north of the Site, near to the Laporte Road Temporary Construction Area (Work No. 9). The Habrough Marsh Drain is part of the North Beck Drain catchment and is located to the west of the Site.
- 21.6.62 The marine area within the Site is located within the Humber Lower Transitional Water Body. The ecological classification (dated to 2019) is defined as 'moderate' and the chemical classification (dated to 2019) is defined as 'fail' for priority hazardous substances Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Mercury and its compounds, Perfluorooctane Sulphonate ("PFOS"), PDBE and Tributyltin Compounds. The 'fail' classification is also associated with priority substances Cypermethrin (Priority hazardous) and Dichlorvos (Priority). The Humber Lower Transitional Water Body is also described as heavily modified.
- 21.6.63 There are approximately 44 Ordnance Survey ("OS") Water Network Lines located on the Site, comprising unidentified inland rivers on the ground surface and underground that are not influenced by normal tidal action. The OS Water Network Lines map provided in the Groundsure Report (GS-9009838) (Ref 21-16) is not clear. However, it indicates that water lines are located across the Site. There are a further 28 OS Water Network Lines within 50m of the Site Boundary,

and 49 OS Water Network Lines between 50m and 500m from the Site Boundary.

21.6.64 There are no licensed surface water abstractions inside, or within 1km of, the Site boundary.

Historical Development

21.6.65 A summary of the historical development inside, and within 500m of, the Site Boundary is provided in **Table 21-17**.

21.6.66 Historical maps from the Groundsure Report (GS-9009838) (Ref 21-16) were referenced to produce a summary of historical development.

Table 21-17: Summary of historical development within the Site and the 500m study area

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
1886 – 1888 (1:2,500 and 1:10,560)	<ul style="list-style-type: none"> • Agricultural fields in all areas of the Site. • ‘North Beck Drain’ is denoted within the Laporte Road Temporary Construction Area (Work No. 9). • A surface water feature and a forested area identified as ‘Long Strip’ (a forested area) are shown in the Pipeline Corridor and Pipe-Rack and Jetty Access Road (Work No. 2 and 6). • ‘Beacons’ are denoted in the Laporte Road Temporary Construction Area (Work No. 9). 	<ul style="list-style-type: none"> • Agricultural fields in all areas of the Site. • ‘North Beck Drain’ is denoted approximately 345m southeast from the West Site (Work No. 9). • ‘Springs’ are denoted at ‘Habrough Marsh’ approximately 185m west from the Pipeline route, approximately 360m south and 400m southeast from the West Site (Work No. 7). • A water feature flowing northeast is shown immediately west from the Pipeline Corridor and East Site (Work No. 3, 3-a, 4, 5 and 5-A). • A ‘Sluice’ is denoted approximately 225m north from the East Site (Work No. 3, 3-a, 4, 5 and 5-A). • A ‘Pump’ is shown approximately 105m east from the Laporte Road Temporary Construction Area (Work No. 9), associated with the ‘Ship Inn’ and ‘Stallingborough Light’ and approximately 320m east from the Site associated with the ‘Coastguard Station’.
1905 – 1906 (1:10,560)	<ul style="list-style-type: none"> • Two ‘Springs’ are shown in West Site (Work No. 7) and two ‘Springs’ are shown within the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8). 	<ul style="list-style-type: none"> • Multiple ‘Springs’ are denoted within a 1km radius from the Site. • A ‘Well’ is denoted at ‘Habrough Marsh’ west of the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8).

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
		<ul style="list-style-type: none"> The pumps at the 'Ship Inn' and 'Coastguard Station' to the east of the Laporte Road Temporary Construction Area (Work No. 9) are no longer shown.
1907 (1:2,500)	<ul style="list-style-type: none"> Water features, assumed to be drains, are shown through the Pipeline Corridor (Work No. 6). 	<ul style="list-style-type: none"> A small pond or lake is denoted adjacent to the Pipeline Corridor (Work No. 6) .
1910 (1:10,560)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> Further 'Springs' are denoted within 1km west from the Site Boundary.
1930 – 1931 (1:10,560)	<ul style="list-style-type: none"> Residential housing is shown adjacent to 'Queens Road' in the West Site (Work No. 7). 'L.N.E.R. Grimsby District Electric Light Railway' is shown through the centre of the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8) orientated northeast to southwest and northwest to southeast. Embankments are denoted either side of the railway. A 'Shelter' is denoted in the centre of the Pipeline Corridor (Work No. 6). 	<ul style="list-style-type: none"> Railway sidings are denoted approximately 80m north from the West Site (Work No. 7). A 'Signal Box', 'Engine Shed' and 'Store' are shown between approximately 130m and 560m northwest from the West Site (Work No. 7). A 'Sewage Works' is denoted approximately 60m east from the Pipeline Corridor and East Site Ammonia Storage site (Work No. 3, 3-A and 6). An 'Allotment Garden' is shown adjacent to the northern boundary of the West Site (Work No. 7). A 'Methodist Church' and a 'Club' are denoted approximately 500m west from the West Site (Work No. 7). The 'Ship Inn', 'Stallingborough Light' and the 'Coastguard Station' are no longer denoted near the Laporte Road Temporary Construction Area (Work No. 9), however, the buildings are still shown.
1932 (1:2,500)	<ul style="list-style-type: none"> The 'North Beck Drain' is diverted outside of the Laporte Road Temporary Construction Area Site Boundary (Work No. 9). A small building is shown near the southern boundary of the Pipeline Corridor (Work No. 6). 	<ul style="list-style-type: none"> A 'Well' is shown near the buildings formerly identified as a 'Coastguard Station' near the Laporte Road Temporary Construction Area (Work No. 9).
1938 (1:10,560)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> No significant changes.
1946 – 1947 (1:10,560)	<ul style="list-style-type: none"> A further small building is denoted near the southern 	<ul style="list-style-type: none"> No significant changes.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
	boundary of the Pipeline Corridor (Work No. 6).	
1947 – 1948 (1:10,560)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> No significant changes.
1947 – 1951 (1:10,560)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> Buildings are denoted approximately 500m west from the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8) near the railway sidings.
1951 – 1956 (1:10,560)	<ul style="list-style-type: none"> A ‘Gypsum Disposal Bed’ is denoted partially on the West Site Boundary (Work No. 7) and extends further southeast off-Site. The ‘L.N.E.R. Grimsby District Electric Light Railway’ is no longer shown in the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8). 	<ul style="list-style-type: none"> Buildings and railway lines associated with a ‘Chemical Factory’ are denoted approximately 350m southeast from the Laporte Road Temporary Construction Area (Work No. 9).
1964 (1:2,500)	<ul style="list-style-type: none"> ‘Drains’ are denoted in the West Site, Queens Road Temporary Construction Area and the Pipeline Corridor (Work No. 6, 7 and 8). Further small buildings are denoted on the boundary of the West Site (Work No. 7). Electricity lines are denoted through the East Site (Work No. 3, 3-a, 4, 5 and 5-A). 	<ul style="list-style-type: none"> Buildings are denoted 30m west from the West Site (Work No. 7). ‘Water’ is denoted immediately south from the West Site (Work No. 7). ‘Pipelines’ are denoted immediately adjacent to the west of the Queens Road Temporary Construction Area (Work No. 8) and approximately 400m west from the Site. One of the railway lines associated with ‘L.N.E.R. Grimsby Electric Light Railway’ is denoted as ‘Disused’ to the northwest of the East Site (Work No. 3, 3-A, 4, 5 and 5-A). Several circular structures are denoted approximately 500m west from the East Site (Work No. 3, 3-A, 4, 5 and 5-A). A ‘Works’ and ‘Tanks’ are shown adjacent to the ‘Sewage Works’ near the Pipeline Corridor (Work No. 6). An ‘Electric Sub Station’ is shown approximately 10m southeast from the

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
		<p>Pipe-Rack and Jetty Access Road (Work No. 2).</p> <ul style="list-style-type: none"> • A 'Jetty' is denoted adjacent to the 'Sluice' on the Humber Estuary approximately 235m north from the East Site area (Work No. 3, 3-a, 4, 5 and 5-A). • 'Drains' are denoted to the east of the Laporte Road Temporary Construction Area (Work No. 9). • A 'Pond' is denoted approximately 80m east from the northeast corner of the Site Boundary. • The 'Chemical Factory' is now denoted as a 'Works'. • Multiple buildings, a 'Chimney' and circular structures associated with a 'Works' are denoted adjacent to 'Green Lane' approximately 270m east from the Laporte Road Temporary Construction Area (Work No. 9). • A 'Jetty' is denoted near the 'Works' approximately 428m east from the Laporte Road Temporary Construction Area (Work No. 9).
<p>1965 – 1968 (1:2,500 and 1:10,560)</p>	<ul style="list-style-type: none"> • The 'Spring' in the west of the Site is no longer shown and further 'Drains' are denoted. 	<ul style="list-style-type: none"> • Several buildings are denoted adjacent to the boundary of the West Site near 'Kings Road' (Work No. 7). • The 'Methodist Church' and 'Club' are no longer denoted, and a 'Hospital' and 'Warehouse' are shown in a similar location. • A 'Sports Ground' and a 'Pavilion' are denoted approximately 450m northwest from the West Site (Work No. 7). • Buildings associated with 'Works' are denoted approximately 500m west from the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8). • The 'Gypsum Disposal Beds' to the east of the West Site (Work No. 7) are no longer shown.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
<p>1969 – 1972 (1:2,500)</p>	<ul style="list-style-type: none"> • Electricity pylons are denoted through the West Site (Work No. 7) and extends further offsite. • ‘Pipelines’ are shown on the northwest Site Boundary in the Pipe-Rack and Jetty Access Road (Work No. 2) which extend off-site. 	<ul style="list-style-type: none"> • An ‘Electric Sub Station’ is denoted approximately 40m west from the East Site (Work No. 3, 3-a, 4, 5 and 5-A). • An ‘Oil Storage Depot’ is denoted approximately 200m west from the East Site (Work No. 3, 3-a, 4, 5 and 5-A). • Multiple ‘Tanks’ are denoted within 500m west from the East Site (Work No. 3, 3-a, 4, 5 and 5-A) associated with the ‘Oil Storage Depot’, an unspecified ‘Works’ and a ‘Chemical Works’. • ‘Electric Sub Stations’ are denoted adjacent to the Site Boundary and approximately 15m west from the West Site (Work No. 7). • A ‘Transforming Station’ and a ‘Pump House’ are shown approximately 25m west and 200m west from the Site (West Site area) respectively (Work No. 7). • The ‘Engine Shed’ associated with the railway sidings located to the north of the West Site area (Work No. 7) is no longer shown, and a ‘Wagon Repair Shed’, ‘Tanks’ and a smaller ‘Engine Shed’ are shown in a similar location. • A ‘Pipeline’ is shown approximately 320m north from the West Site area (Work No. 6) near the railway sidings. • A ‘Warehouse’ and ‘Chemical Works’ are denoted approximately 85m and 80m east from the East Site (Work No. 3, 3-a, 4, 5 and 5-A) respectively on ‘Laporte Road’. • An ‘Oil Storage Depot’ with multiple ‘Tanks’ is denoted approximately 35m north from the East Site (Work No. 3, 3-a, 4, 5 and 5-A), near to the Humber Estuary. • ‘Pipelines’ and ‘Jetty (Oil Terminal)’ are denoted approximately 365m northwest from the East Site (Work No. 3, 3-A, 4, 5 and 5-A) into the Humber Estuary. • Another ‘Chemical Works’ with multiple ‘Tanks’ is denoted approximately 100m east from the northeast corner of the Site.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
1972 – 1976 (1:10,000)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> No significant changes.
1976 – 1979 (1:2,500)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> Further ‘Tanks’ and ‘Chimneys’ are denoted to the west of the East Site associated with the ‘Oil Storage Depot’ and ‘Chemical Works’. Two circular structures are denoted at the ‘Sewage Works’ to the east of the Pipeline Corridor and East Site Ammonia Storage site (Work No. 3, 3-A and 6).. The ‘Works’ near the ‘Sewage Works’ to the east of the Pipeline Corridor (Work No. 6) are no longer denoted. A building associated with ‘GVC’ is shown approximately 270m east from the Laporte Road Temporary Construction Area (Work No. 9). Further buildings and structures are shown associated with the ‘Chemical Works’ to the east of the Laporte Road Temporary Construction Area (Work No. 9).
1980 – 1985 (1:2,500 and 1:10,000)	<ul style="list-style-type: none"> No significant changes. 	<ul style="list-style-type: none"> A ‘GVC’ and ‘Pumping Station’ are located adjacent to the Site Boundary in the West Site area (Work No. 7). A ‘Pipeline’ is shown approximately 70m north from the West Site area (Work No. 7). Another ‘GVC’ is denoted approximately 230m southeast from the Laporte Road Temporary Construction Area (Work No. 9).
1985 – 1987 (1:2,500)	<ul style="list-style-type: none"> The ‘Springs’ in the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8) are no longer shown. 	<ul style="list-style-type: none"> The ‘Transforming Station’ to the west of the West Site (Work No. 7) is now denoted as an ‘Electric Sub Station’ and the ‘GVC’ is denoted as a ‘Gas Valve Compound’. The ‘Water’ denoted immediately south of the West Site (Work No. 7) is no longer shown. The circular structures at the ‘Sewage Works’ to the east of the Pipeline Corridor (Work No. 6) are identified as ‘Filter Beds’.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
		<ul style="list-style-type: none"> • A 'Warehouse' is denoted approximately 500m southeast from the West Site (Work No. 7). • A 'Pipeline' is denoted approximately 410m southeast from the Pipeline Corridor and East Site (Work No. 3, 3-A, 4, 5 and 5-A), near the 'GVC' and 'North Beck Drain'.
1988 (1:10,000)	<ul style="list-style-type: none"> • No significant changes. 	<ul style="list-style-type: none"> • The railway lines associated with the 'Works' adjacent to the Laporte Road Temporary Construction Area (Work No. 9) are now identified as a 'Dismantled Railway'.
2001 (1:10,000)	<ul style="list-style-type: none"> • No significant changes. 	<ul style="list-style-type: none"> • 'Works' are denoted approximately 50m northwest from the West Site area (Work No. 7). • Small ponds are denoted within the 'Oil Storage Depot' to the west of the East Site (Work No. 3, 3-A, 4, 5 and 5-A). • The 'GVC' and 'pipeline' to the southeast of the Laporte Road Temporary Construction Area (Work No. 9) are no longer denoted. • Further 'Works' are denoted adjacent to the eastern Site Boundary in the Laporte Road Temporary Construction Area (Work No. 9).
2010 (1:10,000)	<ul style="list-style-type: none"> • No significant changes. 	<ul style="list-style-type: none"> • A 'Recycling Centre' is denoted adjacent to the West Site boundary (Work No. 7). • A pond is shown approximately 50m southeast from the West Site (Work No. 7).
2022 (1:10,000)	<ul style="list-style-type: none"> • No significant changes. 	<ul style="list-style-type: none"> • The 'Recycling Centre' located to the West Site (Work No. 7) is no longer shown. • Further ponds are shown to the southeast of the West Site (Work No. 7). • Circular structures associated with the 'Oil Storage Depot' near the Humber Estuary are no longer shown and a 'pipeline' through the Port to the west of the Site is no longer shown.

Regulated Processes and Pollution Incidents

21.6.67 The following regulated processes and pollution incidents are recorded on the Site and within 500m of the Site Boundary:

- a. Recent industrial land uses on the Site include water pumping stations, energy production (landfill gas and a power station), vehicle services (hire, rental, services and repairs), industrial engineers, pylons, a chimney, tools and machine shops, recycling, reclamation and disposal and a gas governor.
- b. Within 50m from the Site Boundary, there are electrical features (pylons, electric sub stations), telecommunications, engineering services, distribution and haulage services, hoppers and silos, gas valve compounds, industrial products, fuel distributors and supplies, moorings and unloading facilities, recycling centres plasterboard manufacturer and a gas governor.
- c. Three current Control of Major Accident Hazards (“COMAH”) Upper Tier sites associated with Exolum Immingham Limited and Associated British Ports (“ABP”) are recorded within the Site Boundary. An historical Notification of Installations Handling Hazardous Substances (“NIHHS”) site is located within the Site Boundary associated with Arkema Coatings Resin Limited.
- d. A current COMAH site is located approximately 23m southeast from the Site Boundary relating to Tronox Pigment UK Limited. A current lower tier COMAH site is operated by Associated British Ports approximately 432m northwest from the Site.
- e. There are three hazardous substance storage/usage sites located at the following locations: approximately 68m south currently associated with Arkema Coatings Ltd; 118m northeast operated by Associated Petroleum Terminals and 365m northwest operated by Origin UK Ltd.
- f. Permits for Integrated Pollution Control records are held approximately 57m northeast for petroleum processes operated by Associated Petroleum Terminals. Permits are held by the following operators approximately 400m south from the Site: Innogy Cogeneration Ltd (for combustion processes); Millennium Inorganic Chemicals Ltd (for acid processes) (revoked) and Npower Cogen Energy Ltd (for combustion processes) (revoked). Millennium Inorganic Chemicals Ltd held permits for halogen processes approximately 486m southeast from the Site.
- g. UK Power Reserve Limited hold a permit for licenced industrial activity (fuel combustion) within the Site Boundary. There are multiple records for licenced industrial activities within 500m from the Site including Arkema Coatings Resins Limited approximately 80m south; UK Power Reserve Limited approximately 80m southwest; Immingham Power Limited approximately 81m southeast; Associated Petroleum Terminals Ltd approximately 110m north; Associated Petroleum Terminals Ltd approximately 145m northeast; Knauf UK approximately 300m northwest and 370m northwest; North Beck Energy Limited approximately 320m east; Integrated Waste Management approximately 320m southeast; PX Ltd and Npower Cogen Ltd approximately 350m southeast and 380m southeast; and Millennium Inorganic Chemicals,

Tronox Pigment UK Ltd and Cristal Pigment UK Ltd approximately 486m southeast.

- h. Knauf UK (Gypsum) hold a permit for other mineral processes within 50m of Work No.10 and approximately 180m northwest from the rest of the Site.
- i. There are no records for radioactive substance authorisations within the Site Boundary. FCC Recycling (UK) Limited have an approved permit for keeping and use of radioactive materials and disposal of radioactive waste. Millennium Inorganic Chemicals Ltd held a permit for radioactive substance authorisations for the disposal of radioactive waste approximately 480m south. The status is recorded as revoked/cancelled.
- j. Anglian Water Service Limited and Immingham Water Recycling Centre hold permits for licenced discharges to controlled waters for sewage discharges into the River Humber located within the Site Boundary.
- k. Two permits for licenced discharge into controlled waters were held on the Site Boundary for sewage discharges into an unknown tributary of the North Beck Drain, although these were revoked in May 1995 and December 2000. Further permits are held between 60m northwest and 260m northwest associated with sewage discharges, trade effluent and miscellaneous surface water discharges.
- l. Pollution inventory substance records indicate that Non-Methane Volatile Organic Compounds (“NMVOCs”), methane, nitrogen oxides are reported annually as part of the Queens Road Power Station within the Site Boundary. Records are provided for reporting thresholds of other substances as a result of the Queens Road landfill which encroaches on the boundary of the Site. In addition records are provided for methane, nitrogen oxides and carbon dioxide relating to Knauf GmbH, a plasterboard manufacturer which is located approximately 50m from Kings Road Work No.10
- m. Pollution inventory waste transfer records are held within the Site Boundary associated with the Queen’s Road Power Station and Queens Road landfill which encroaches on the Site Boundary. The descriptions relate to septic tank sludge, mixed municipal waste, street cleaning residues, landfill leachate.
- n. List 1 Dangerous Substance, taken from the Groundsure report GS-9009838, records include Riverside Electroplaters who operate a discharge of cadmium into the River Humber located within the Site Boundary. List 1 Dangerous Substances are held at Immingham Landfill Site and the Tankclean Tankwash site approximately 124m southeast. Immingham Oil Terminal and Millenium Inorganic Chemicals (now Tronox) have authorisation for the discharge of mercury (other) and cadmium approximately 375m northwest and 486m southeast respectively. Immingham Stw discharged List 1 Dangerous Substances approximately 124m southeast, however, this is no longer active.
- o. List 2 Dangerous Substance, taken from the Groundsure report GS-9009838, records within 50m of the Site Boundary include historical releases of pH by Jefco Services Ltd approximately 9m northeast and unknown substances by Immingham Stw approximately 50m southeast. Associated Petroleum Terminals discharge iron and zinc into the River Humber approximately 59m

northwest. Further List 2 Dangerous Substance discharge records are held between approximately 124m southeast and 375m northwest.

- p. A pollution incident was recorded on 21 February 2003 associated with adhesives approximately 15m northwest from the Site. The land and air impact were recorded as Category 4 (No Impact) and the water impact was recorded as Category 3 (Minor).
- q. A pollution incident occurred on 20 August 2001 approximately 78m northwest associated with oils and fuels. The water impact was recorded as Category 3 (Minor) and the air and land impact was recorded as Category 4 (No Impact). Another pollution incident occurred on 27 June 2003 approximately 79m southeast associated with organic chemicals / products. The air impact was recorded as Category 3 (Minor) and the water and land impact was recorded as Category 4 (No Impact). A pollution incident occurred on 25 July 2002 approximately 339m southeast associated with specific waste materials. The water, land and air impact were recorded as Category 4 (No Impact).
- r. Pollution inventory substance records are held approximately 80m southwest (UK Power Reserve Limited), 81m southeast (Integrated Waste Management Limited), 347m southeast (Tronox Pigment UK Limited) and 367m northwest (Knauf UK).
- s. Pollution inventory waste transfer records are held approximately 80m southwest (UK Power Reserve Limited), 81m southeast (Integrated Waste Management Limited), 347m southeast (Tronox Pigment UK Limited) and 367m northwest (Knauf UK).

Landfills

- 21.6.68 An active landfill is partially located on the eastern side of the Site Boundary, within the West Site area (Work No. 7). The landfill is operated by Integrated Waste Management Ltd with a capacity of >25,000 tonnes excluding inert waste. The status is recorded as effective.
- 21.6.69 The border of a historical gypsum disposal bed waste site encroaches on the south-eastern side of the Site Boundary, within the West Site (Work No. 7) and Pipeline Corridor (Work No. 6) of the site. A further historical waste site (landfill works) is located within the Site Boundary in the West Site. A waste transfer station is located 458m east from the Site.
- 21.6.70 Two historical landfill sites are recorded on the south eastern boundary of the West Site and Pipeline Corridor (Work No. 6 and 7) and 369m southeast from the West Site within the Site, associated with refuse tips. A further historical landfill is located approximately 92m northwest from the proposed pipeline route within the Site associated with inert and industrial waste. The last input date was recorded as 31 December 1990.
- 21.6.71 There are five licenced waste sites located between 41m and 304m from the Site Boundary:

- a. Immingham Household Waste Recycling Centre encroaches within the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8), and is associated with household, commercial and industrial waste with a capacity for 25,000 tonnes. The status is recorded as 'modified'.
- b. Immingham Landfill Site is located 41m southeast from the West Site associated with household, commercial and industrial waste with a capacity of 25,000 tonnes. The permit status is recorded as To Pollution Prevention Control ("PPC").
- c. Sandstop Recycling is located approximately 98m northwest from the Queens Road Temporary Construction Area (Work No. 8) and is associated with inert and excavation waste and treatment with a capacity of 25,000 tonnes. The status is recorded as 'surrendered' dated March 2017.
- d. Immingham Oil Terminal is located approximately 108m north from the East Site Hydrogen Production site (Work No. 5 and 5-A) and is associated with household, commercial and industrial waste with a capacity of 75,000 tonnes. The status is recorded as 'modified'.
- e. Immingham Landfill Site is located approximately 213m southeast from the West Site (Work No. 7) and is associated with a co-disposal landfill site and household, commercial and industrial waste. The capacity of the co-disposal site is recorded as 75,000 tonnes and the capacity of the household, commercial and industrial waste site is recorded as 25,000 tonnes. The permit status of the site is recorded as Integrated Pollution Prevention and Control ("IPPC").

21.6.72 Immingham Dock Special Waste Transfer Station is located approximately 304m north from the East Site with a 25,000-tonne capacity. The status is recorded as 'surrendered' dated March 2000.

21.6.73 There are five records for waste exemptions between 50m and 250m from the Site, and a further twelve between 250m and 500m from the Site Boundary.

Environmental and Geotechnical Risk Assessments

21.6.74 To inform the design-development of the Project and establish existing conditions at the Site, an Environmental Risk Assessment ("ERA") was undertaken in 2022 and reported in the Immingham Green Energy Terminal Phase 1 Geo-environmental and Geotechnical Desk Study (Ref 21-63), as well as a Geotechnical Risk Assessment and an Initial Ground Hazards Assessment (reported in the Immingham NH3 Import Terminal Development Appraisal Report (Ref 21-17)).

21.6.75 The ERA has been updated following the completion of a human health and controlled waters screening exercise, reported in **Appendix 21.B Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4]**.

21.6.76 The updated ERA has identified the following risks:

- a. The risk to future site users is considered *Low* for contaminant linkages associated with direct contact, ingestion and inhalation from contaminants within soil, soil leachate and groundwater. The risk to future site users is

considered *Moderate / Low* for contaminant linkages associated with the inhalation of ground gas.

- b. The risk to construction workers is considered *Moderate/Low* to *Moderate* for all contaminant linkages.
- c. The risk to adjacent site users is considered *Low* for all contaminant linkages.
- d. The risk to buildings and infrastructure is considered *Moderate/Low* to *Moderate* for all contaminant linkages.
- e. The risk to shallow groundwater (within Secondary Undifferentiated Aquifer) is considered *Moderate* for contaminant linkages associated with contaminants in groundwater and soil leachate for on-site sources and *Moderate/Low* for off-site sources. The risk to shallow groundwater associated with potential contaminants within the soil is considered *Very Low*.
- f. The risk to deep groundwater (Principal Aquifer of the Flamborough Chalk Formation) is considered *Moderate* for contaminant linkages associated with contaminants in groundwater and soil leachate for on-site sources and *Moderate / Low* for off-site sources. The risk to deep groundwater associated with potential contaminants within the soil is considered *Low*.
- g. The risk to surface water is considered *Moderate* for contaminant linkages associated with contaminants in groundwater and soil leachate. The risk to surface associated with potential contaminants within the soil is considered *Low*.
- h. The risk to flora and fauna is considered *Very Low* to *Low*.

21.6.77 An updated Geotechnical Risk Assessment has been undertaken and is presented in **Appendix 21.B Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4]**.

21.6.78 The updated Geotechnical Risk Assessment identified the following medium to high risks:

- a. A *medium* risk associated with the presence of Made Ground.
- b. A *high risk* associated with aggressive ground and groundwater conditions that may degrade buried concrete and steel.
- c. A *medium risk* associated with existing underground and overhead services.

Future Baseline

21.6.79 The future baseline conditions for ground conditions and land quality are anticipated to remain unchanged from those as described in **Section 21.6** in the absence of the Project.

21.7 Development Design and Impact Avoidance

21.7.1 Details of the embedded and standard mitigation measures in relation to the geological and hydrogeological environment for the construction and operational phases of the Project are provided in the following sections, with a summary of these measures presented in **Table 21-19**.

Embedded Mitigation Measures

- 21.7.2 The Project has been designed, as far as possible, to avoid and minimise impacts, effects and risks to ground conditions and land quality receptors through the process of design-development, and by embedding mitigation measures into the design.
- 21.7.3 Specific measures include building and foundation design, and institutional controls for the prevention of contamination associated with operations at the Site through an Environmental Permit.
- 21.7.4 Measures relating to remediation to manage any significant and unacceptable contamination risks identified as part of this assessment are presented in the **Outline Remediation Strategy** for the landside elements of the Site forming part of **Appendix 21.C [TR030008/APP/6.4]**. Detailed Ground Investigation information was available for majority of the landside extent of the Site to inform the preparation of the **Outline Remediation Strategy** but no detailed data were available for the Pipeline Corridor (Work No. 6) or the narrow corridor through the Long Strip woodland for the Pipe Rack and Jetty Access Road (Work No. 2) was unavailable for inclusion. Ground Investigation data for those more limited areas will be available shortly. The absence of data from these more limited areas would not affect the conclusions of the land quality assessment presented in this chapter as it is prepared on a 'realistic worst case', which assumes unknown contamination could be present in these areas.
- 21.7.5 The content of **Outline Remediation Strategy** forming **Appendix 21.C [TR030008/APP/6.4]**, will form the basis of a Final Remediation Strategy, in which the potential for re-use of surplus materials on Site, and the potential for disposal or onward management will be considered to ensure appropriate re-use of materials off Site. If it is identified that surplus materials can be reused on Site, the Final Remediation Strategy (or Strategies) will define any treatment measures required and a risk-based compliance criteria for soils to be screened against prior to reuse. If soil materials are considered to be surplus, the soil materials will be classified under the Waste Framework Directive ("Waste FD") (2009/98/EC) (Ref 21-64) as hazardous (17-05-03) or non-hazardous (17-05-04) soils using a propriety assessment tool (e.g., "HazWasteOnline™"). WAC testing will be required if waste is deemed as hazardous before disposal in a landfill. The Final Remediation Strategy (or Strategies) will be prepared by the contractor in accordance with the **Outline Remediation Strategy** forming **Appendix 21.C [TR030008/APP/6.4]**, prior to the commencement of construction in the relevant part of the Site and secured by Requirement in the draft DCO.
- 21.7.6 Given that asbestos was encountered in the Ground Investigation and that asbestos presence has been confirmed and quantified through chemical screening, an Asbestos Management Plan ("AMP") has been prepared to manage this risk during the construction phase. The AMP has been appended to the Outline CEMP **[TR030008/APP/6.5]** as Appendix E.
- 21.7.7 To ensure suitable re-use of materials such as crushed concrete and soils a Materials Management Plan ("MMP") will be produced for the Project and incorporated into the Final CEMP, as noted in the Outline CEMP **[TR030008/APP/6.5]**. This will accord with the provisions of the CL:AIRE

Definition of Waste Code of Practice (“DoW CoP”) and demonstrate that material has been deposited in an appropriate manner and will not pose an unacceptable risk to human health or the environment. A completed MMP will be submitted to a Qualified Person for approval, a declaration will be issued under the CL:AIRE DoW CoP and approved by CL:AIRE and will be submitted to the Environment Agency for its records, before any works to which the MMP relates commence.

- 21.7.8 Following the Ground Investigation and geotechnical assessments, the construction methodology of the Project will be assessed prior to commencement of the Project (as noted in the **Outline CEMP [TR030008/APP/6.5]**) to consider and reduce if necessary the potential risk associated with the development of preferential pathways if piling, other deep foundations or ground improvements are required. Preferential pathways may be created between the Made Ground, superficial Secondary Undifferentiated Aquifers and the Principal Aquifer in the bedrock as a result of the construction of the Project. For example, if piled foundations are required and contamination is identified on the Site, it is anticipated that a piling risk assessment will be undertaken which will comply with industry best practice such as the EA Guidance “Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention” (Ref 21-23) and “Piling in Layered Ground: risks to groundwater and archaeology – Since Report SC0200074/SR” (Ref 21-24). Piling method statements will detail measures to protect the aquifer if there is potential to cause pollution.
- 21.7.9 Impermeable surfacing and bunding may be incorporated into the detailed design of the Project, where appropriate, to mitigate potential effects associated with the accidental spillage of polluting materials.
- 21.7.10 To mitigate the potential risk to development infrastructure, the Project’s operational infrastructure and selection of materials will be designed in a manner that accounts for any potential aggressive ground conditions identified through the Ground Investigation. This includes incorporating appropriate ground gas mitigation measures within buildings, in accordance with BS8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (Ref 21-62).

Standard Mitigation Measures

- 21.7.11 Standard mitigation measures have been identified for implementation by the contractor during the construction, operation and decommissioning phases of the Project. Throughout all Project phases, the contractor will be required to comply with all relevant Health and Safety legislation when undertaking works, activities and operations within the Site.

Construction Phase

- 21.7.12 The contractor will be required to prepare a final CEMP prior to construction.
- 21.7.13 An **Outline CEMP [TR030008/APP/6.5]** has been prepared as part of the DCO application. This document describes the measures identified to limit the dispersal and accidental release of soil derived dusts, uncontrolled run-off and

accidental releases of potential contaminants. Example measures are summarised as follows.

- 21.7.14 Best practice guidance and mitigation measures will be adhered to during construction, in order to prevent or minimise spillage risks and impacts during the construction phase. The measures also address accidental spillages associated with building construction, foundations, concrete usage and the management of concrete batching.
- 21.7.15 To minimise the potential for run-off from material stockpiles to surface water bodies, any stockpiled material stored on the Site will be stored at a suitable distance from watercourses. If such material stockpiles are not used within three months, temporary covers will be implemented. Erosion protection matting may also be used. Collectively, these measures will minimise the potential for sediment mobilisation via wind and water flows.
- 21.7.16 Topsoil removal or stockpiling isn't proposed in the Laporte Road Temporary Construction Area as soils will need to be levelled and compacted, prior to use as a laydown area. This area will be subject to light grading, with a breathable heavy duty ground mat protection applied following these works to reduce potential compaction from materials laydown and associated activities.
- 21.7.17 To further prevent the potential for surface run-off and mobilisation of potential contaminants, any washing of vehicles and equipment will be undertaken in controlled areas only. Such locations will be defined in the Final CEMP, which will be submitted to, and approved in writing by, the local planning authority. **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2] and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** discuss further standard mitigation measures to be implemented in order to prevent and minimise potential pollution to surface watercourses, including the use of an oil spill contingency plan and spill kits on site.
- 21.7.18 Construction workers on Site will adhere to the CEMP and site-specific health and safety risk assessments, legislation and regulations as set out in the Construction Phase Plan to be produced by the contractor.
- 21.7.19 Site-specific risk assessments and the use of personal protective equipment will form a pre-requisite for workers coming onto Site. Entry into excavations or any other enclosed space on a construction site will comply with confined space legislation and be assessed prior to entry. To minimise the risk to off-site human health, general best practice guidance will be followed on Site to minimise dust generation, as outlined in "Environmental Good Practice on Site", 4th Edition, CIRIA Publication C692 (Ref 21-29) and in accordance with measures set out in the **Outline CEMP [TR030008/APP/6.5]**.

- 21.7.20 Potential impacts specific to contamination impacting on soil resources will be mitigated through the following measures:
- a. Works will be in compliance with BS 3882:2015 'British Standard Specification for Topsoil and Requirements for Use' (2015) and the Construction Code of Practice for the sustainable use of soils on construction sites (Ref 21-65).
 - b. The source of topsoil will be investigated carefully with respect to its suitability for the intended use.
 - c. A Soil Resource Plan will be prepared by the contractor prior to the start of construction, detailing the areas and type of topsoil/subsoil to be stripped, stripping method, haul routes and the management of the soil stockpiles.
 - d. Topsoil will be handled only in the appropriate conditions of weather and soil moisture, and with suitable machinery.
 - e. The stockpiling of soils will be avoided whenever possible. Where stockpiling is unavoidable, heaps would be tipped loosely and the surface firmed and shaped to shed water.
 - f. Where possible, topsoil will be re-used on site as applicable.
 - g. The movement of traffic will be confined to designated haul routes to reduce the amount of heavy machinery going over soil materials which could cause compaction of soil materials. Such routes would exclude areas of proposed landscaping.
 - h. Following the completion of construction activities, agricultural land taken on a temporary basis will be restored and returned to the landowner for unrestricted agricultural use, and returned in the same agricultural condition that currently exists (refer to **Section 21.6**).
- 21.7.21 An Outline Soil Management Plan is provided as Appendix B to the **Outline CEMP [TR030008/APP/6.5]**.
- 21.7.22 If dewatering is required or trenchless techniques are required in high sensitivity groundwater environments, or if dewatering is required for open cut installation, a hydrogeological assessment will be undertaken. This will consider the impact on nearby abstractions/resources and potential draw down. A dewatering scheme will be prepared and implemented to manage water arising from the operations and water treatment prior to controlled discharge. Further information on dewatering is provided in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.
- 21.7.23 Subject to the grant of the DCO, construction of the Project (save certain enabling works) would only be able to commence once the Final CEMP has been submitted to and approved by the Planning Authority. This will be secured by a requirement included in the draft DCO **[TR030008/APP/2.1]** and will be in accordance with the measures detailed in the **Outline CEMP [TR030008/APP/6.5]**.

Operational Phase

- 21.7.24 The Project will operate in accordance with and comply with relevant legislation and regulations, and the hydrogen production facility will be regulated by the EA through an Environmental Permit.
- 21.7.25 Potential impacts associated with the accidental spillage of polluting materials during the operational phase will be mitigated by way of process monitoring and implementation of an Environmental Management System as required by ISO14001:2015 Environmental Management Systems. **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2] and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses during the operational phase.
- 21.7.26 Appropriate emergency environmental management plans and procedures, in accordance with legislation and regulations, will be in place for the operational stage. Operational workers will comply and adhere to appropriate site and task specific health and safety documentation required for legal compliance. Workers will comply with confined space legislation and assessments. If maintenance workers are required to undertake excavations during the operational phase, task and site-specific assessments would be undertaken for each sub area of the Site, and sufficient information will be provided for such assessments to be undertaken. Workers will be required to use personal protective equipment prior to coming onto Site. The storage of hazardous substances during the operational phase will be approved by NELC through a Hazardous Substances Consent and regulated by the Health and Safety Executive (as the competent authority) and the Environment Agency through COMAH. Further information relating to these measures is presented in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

Decommissioning Phase

- 21.7.27 An **Outline Decommissioning Environmental Management Plan (“DEMP”)** [TR030008/APP/6.6] has been prepared as part of the DCO application to explain how impacts associated with the decommissioning of hydrogen production facility will be minimised or avoided.
- 21.7.28 The construction workers at the Site during the decommissioning phase will follow general best practice guidance and adhere to site specific health and safety risk assessments, legislation and regulations.
- 21.7.29 To minimise the mobilisation of potential contaminants from material stockpiles, stockpiled material will be stored at a suitable distance from watercourses and suitably covered (if not used within three months).
- 21.7.30 A final DEMP will be prepared by the demolition contractor, and will contain the measures detailed in the **Outline DEMP [TR030008/APP/6.6]**. The final DEMP will be secured by way of requirement in the draft DCO [TR030008/APP/2.1].

21.8 Assessment of Likely Impacts and Effects

- 21.8.1 This section discusses the likely impacts and effects identified for human health, geology and controlled waters receptors as a result of the Project.
- 21.8.2 As described in **Paragraph 21.4.9**, the assessment of the likely significant effects of the Project has been based on the implementation of both embedded and standard mitigation measures summarised in **Section 21.7**. Where likely significant effects are predicted to remain following the implementation of these measures, additional mitigation measures have been identified to further reduce their significance where possible.

Receptors

- 21.8.3 Based on a review of the baseline environment described in **Section 21.6**, **Table 21-18** identifies the type and location of relevant environmental receptors, detailing their relationship to the Site Boundary, their sensitivity rating, and the rationale for their inclusion in the assessment scope (i.e. where potential impact pathways exist). The assessment of ground conditions and land quality at the Site has been undertaken using previous and recent Ground Investigation data, including potential contamination sources, receptors and plausible pollutant linkages.

Table 21-18: Value (sensitivity) of Receptors

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Human Health				
Human Health	Workers and site visitors	On site	Medium	Workers and site visitors on Site are considered to be of Medium sensitivity due to the commercial/industrial land use. The workers and site visitors may be a receptor to potentially contaminated groundwater, soils and dust.
Human Health	Workers and site visitors	Off site	Medium	The workers and site visitors located off-site are considered to be of Medium sensitivity due to the commercial/industrial land use within the wider area, including the Port of Immingham. The off-site workers and site visitors may be a receptor of potential contaminated groundwater, dust and vapours that could migrate offsite.
Human Health	Residential properties within the 500m study area	Off site within 500m study area	Very high	Residents of properties within the 500m study area are considered to be very high sensitivity due to the commercial/industrial land use within the wider area, including the Port of Immingham. Residents may be a receptor of potential contaminated groundwater, dust and vapours that could migrate offsite.
Geology (Bedrock)				
Geology Bedrock	Flamborough Chalk Formation Burnham Chalk Formation	The Flamborough Chalk Formation underlies the superficial deposits across the entire Site, apart from the western Site Boundary and Kings Road Work No.10. The Burnham Chalk Formation underlies	Negligible	There are no geological exposures, and little/no local interest. The bedrock is overlain by thick superficial deposits.

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
		the western Site Boundary and Kings Road Work No.10.		
Geology Superficial				
Geology	Tidal Flat Deposits	The entire Site, apart from the bank of the Humber Estuary.	Negligible	There are no geological exposures, and little/no local interest. In some areas, the Tidal Flat Deposits are overlain by Made Ground.
Geology Superficial	Beach and Tidal Flat Deposits (Undifferentiated)	Northeastern boundary of the Site, along the bank of the Humber Estuary.	Negligible	There are no geological exposures and little/no local interest.
Geology Superficial	Devensian Till	The entire Site, underlying the Tidal Flat Deposits.	Negligible	There are no geological exposures and little/no local interest. The Devensian Till is overlain by Tidal Flat Deposits.
Soils				
Soils	Soils (Beach and Tidal Flat Deposits and Tidal Flat Deposits)	The entire Site.	Medium	The West Site and the eastern half of the Temporary Construction Area are designated as ALC Grade 3b.
Soils	Agricultural soils	Laporte Road Temporary Construction Area	Medium	Agricultural soils in this area will be left in situ and not stripped or stored, and accordingly these resources may be subject to a degree of compaction during construction (associated with the laydown of materials).

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Hydrogeology and Hydrology				
Groundwater (Bedrock)	Principal Aquifer (Chalk)	The entire Site.	Very High	The Chalk bedrock geology is designated as a Principal Aquifer, and there are multiple groundwater abstractions within a 1km radius from the Site. An SPZ1, 2 and 3 are located within the Site Boundary associated with a groundwater abstraction approximately 27m northwest from the Site. Unproductive superficial deposits may provide some protection to the Principal Aquifer. However, the borehole records indicate there are higher permeability layers of strata such as sand and warp.
Groundwater (Superficial)	Secondary (Undifferentiated) Aquifer (Beach and Tidal Flat Deposits (Undifferentiated)	Northeastern boundary of the Site, along the bank of the Humber Estuary.	Low – Medium	The Beach and Tidal Flat Deposits may support groundwater of a minor value as it is a Secondary Aquifer.
Groundwater (Superficial)	Unproductive Aquifer (Tidal Flat Deposits)	The entire Site, apart from the bank of the Humber Estuary.	Low	The Tidal Flat Deposits comprise of unproductive strata and are therefore designated as an Unproductive Aquifer.
Surface Water	Humber Estuary	The Humber Estuary is located within the Site Boundary to the northeast of the Site.	High	The Humber Estuary is a WFD waterbody with a ‘moderate’ ecological classification and a ‘fail’ chemical classification in 2019.
Surface Water	North Beck Drain catchment	The North Beck Drain is located immediately east from the Site.	High	The North Beck Drain is a WFD waterbody with a ‘moderate’ ecological classification and a ‘fail’ chemical classification in 2019.

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Surface Water	Habrough Marsh Drain	To the west of the Site.	High	The Habrough Marsh Drain is part of the North Beck Drain catchment, which had a 'moderate' ecological classification and a 'fail' chemical classification in 2019.

Pathways

- 21.8.4 The assessment has identified the following pathways as having the potential to directly and/or indirectly impact on identified receptors during the construction, operational and decommissioning phases of the Project:
- Direct contact with contamination.
 - Inhalation of dust and/or soil derived vapours.
 - Migration of ground gas.
 - Vertical and lateral migration of contaminants via groundwater and surface run-off.
 - Soil compaction.
- 21.8.5 **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** considers the in-combination effects relating to the topic of ground conditions and land quality, in addition to controlled waters and human health which could arise from the Project.
- ### Construction Impacts and Effects
- 21.8.6 This section contains an assessment of the likely impacts and effects on ground conditions including land quality receptors as a result of the construction phase on the Project.
- 21.8.7 There is potential for sediment bound contaminants of concern to be mobilised as a result of dredging operations for the marine element of the Project. These potential impacts are discussed further in **Chapter 17: Marine Water and Sediment Quality and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.
- Direct contact with contamination and inhalation of dust/soil derived vapours*
- 21.8.8 Residents within the 500m study area, site visitors and on-site workers are considered the main human health receptors likely to be affected by the construction phase.
- 21.8.9 If contaminated soils are encountered in the course of excavation and construction works, there are likely impacts on human receptors. Construction activities on the Site including foundation construction, earthworks, excavations and movement of ground materials may expose on site workers and future site visitors to potentially contaminated dust. The construction activities may result in the removal, relocation or mobilisation of existing potential contaminants which could have an adverse effect on human health.
- 21.8.10 During the 2023 Ground Investigation two samples out of thirty analysed noted to contain asbestos or asbestos containing materials ("ACMs2). Both samples came from the East Site, Hydrogen Production (Works No 5).

- 21.8.11 The sensitivity of residents within the 500m study areas is considered to be *very high* and the magnitude of impact is considered to be *negligible*. The sensitivity of the workers on the Site is *medium* and the magnitude of impact on human health is *minor*. Accordingly, with embedded and standard mitigation measures adopted and implemented as outlined in **Section 21.7** the significance of effect from the uncontrolled release of potentially contaminated soil- derived dust, including asbestos, contaminated surface water run off or groundwater on human health receptors is considered to be **slight adverse**, which is **not significant**.
- 21.8.12 The construction phase may result in adverse impacts on the geology (which has a *negligible* to *low* sensitivity) and soils (which have a *medium* sensitivity) underlying the Site through the potential risk of creating new Source-Pathway-Receptor linkages. The soils on the Site could be degraded through the construction activity due to the presence of heavy plant machinery and vehicle movement. The construction phase may also result in increased soil erosion, changes in topography and ground stability impacts. Waste soils may be generated in the event that the soils cannot be reused within the Site and will hence require off-site disposal. However, standard and embedded mitigation practices will remove the potential for adverse impacts to geology and soils. Therefore, the significance of effect on geology is considered **neutral** and on soils is **slight adverse** which are both **not significant**.
- 21.8.13 There is potential for beneficial effects during the construction stage if any contaminated soil that is encountered is treated or removed, thereby removing the likely adverse effects on the receptor. Drainage design for the Site will also reduce the potential for soil erosion.

Migration and accumulation of ground gas

- 21.8.14 Ground gas has the potential to accumulate within temporary structures during the construction phase. The Ground Investigation undertaken by RSK (Ref 21-18) of the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8) recorded elevated methane concentrations. In addition, the 2023 Ground Investigation by AECOM also observed elevated methane concentrations and high flow rates during ground gas monitoring rounds.
- 21.8.15 The sensitivity of human health receptors in relation to effects from accumulation of ground gas in confined spaces has been classed as *medium* with a *moderate* magnitude. With the standard and embedded mitigation practices in place it is concluded that there will be a **slight adverse** effect, which is classed as **not significant**.

Vertical and lateral migration of contaminants via groundwater and surface run-off

- 21.8.16 During construction there is the potential that a pathway may be created for contamination to impact controlled waters (Secondary Undifferentiated Aquifer, Unproductive Aquifer, Principal Aquifer, Humber Estuary, North Beck Drain and Habrough Marsh Drain).

- 21.8.17 In addition, during the construction phase potential disruption to shallow groundwater may arise as a result of excavations and foundations. Excavations may fill with groundwater and therefore require temporary groundwater controls such as physical cut-offs or dewatering. In the immediate area of the excavation, it is likely that the groundwater levels would be lowered. Preferential flow pathways for groundwater may also be created as a result of service trenches. Dewatering controls may also draw contaminated groundwater on Site if any contaminated groundwater is present. This may result in changes to the hydrogeological regime and may affect the aquifers beneath the Site.
- 21.8.18 The bedrock aquifer has a sensitivity rating of *very high* and the magnitude of impact is considered *minor adverse*. The superficial deposit aquifers have a low to *medium* sensitivity and the magnitude of impact is considered *minor adverse*. However, it is anticipated that with standard and embedded mitigation controls in place this will lead to a **slight adverse** effect which is **not significant**.
- 21.8.19 There is potential for accidental spillages and leakages associated with fuels and oils from vehicular plant equipment, stored liquids and other polluting materials which could potentially be mobilised to surface water and groundwater as a result of run-off and lateral or vertical migration. With a minor adverse magnitude of effect on bedrock aquifers which have a *very high* sensitivity and superficial deposits that have a *low to medium* sensitivity and surface waters with a *high sensitivity*, the effect of impact to controlled waters with standard and embedded mitigation controls in place is considered to be slight adverse which is not significant.
- 21.8.20 Preferential pathways and new Source-Pathway-Receptor linkages may be created during the construction phase, particularly if piled foundations are required through Made Ground into underlying natural soils or bedrock. The Ground Investigation site specific data identified a risk to aquifers beneath the Site from the quality of the groundwater and aggressive ground conditions. This may result in adverse impacts to the superficial (Unproductive and Secondary Undifferentiated Aquifers of the Tidal Flat Deposits and Beach and Tidal Flat Deposits respectively) which have a *low to medium* sensitivity and bedrock aquifers (Principal Aquifer of the Flamborough Chalk Formation) which have a *very high* sensitivity. However, with standard and embedded mitigation controls in place the effect is considered to be **slight adverse** which is **not significant**.

Soil compaction

- 21.8.21 During construction, work will be necessary to prepare and improve the ground within the Laporte Road Temporary Construction Area (Work No. 9), prior to receiving materials for laydown and storage.
- 21.8.22 Although works at this location will be minimal, potential exists for compaction of soils resources from the process of light grading and compaction, which is required to form a level, stable surface for storage and to allow the construction workforce to safely navigate around the area.

- 21.8.23 As the ALC Grade 3b soils in this location will be covered and protected with breathable heavy duty ground mat protection, the assessment has identified that this *medium sensitivity* receptor will experience a *minor adverse* magnitude of impact (as effects will be temporary) with this matting in place. The effect of this will be **slight adverse** which is **not significant**.

Loss of Soil Resource

- 21.8.24 Work No. 7 on the West Site would take place on an area of fields, which were formerly used for agricultural purposes, but the agricultural use has ceased.. The area is allocated in the Local Plan for light industrial use. The area benefits from an extant planning permission for light industrial development and an entrance and spine road has been put in place pursuant to that permission to facilitate that development. The soils are considered to be agricultural grade 3b. However, some loss of fertility associated with cessation of the agricultural use is assumed. The sensitivity of grade 3b agricultural soils is *medium*. In terms of the impact of the Project on the soil resource, the cessation of agricultural use has already taken place and planning permission for light industrial development of this site has been obtained and implemented, including some loss of soil resource. Given this, the effect of the Project is considered to be **slight adverse** and **not significant**.

Operational Impacts and Effects

- 21.8.25 This section contains an assessment of the likely impacts of the operational phase on the Project.
- 21.8.26 The following impact pathways have been assessed prior to the implementation of mitigation measures and then appropriate mitigation measures are identified:
- Direct contact with contamination.
 - Inhalation of dust and/or soil derived vapours.
 - Migration of ground gas.
 - Vertical and lateral migration of contaminants via groundwater and surface run-off.

Direct contact with contamination and inhalation of dust / soil derived vapours and ground gas

- 21.8.27 Although future on site workers and site visitors are anticipated to spend longer durations of time on the Site than construction and maintenance workers, it is anticipated that direct contact and inhalation will be unlikely due to the presence of hardstanding on the Site which will remove the pathway in the pollutant linkage. Direct contact and inhalation are also considered unlikely as standard and embedded mitigation practices will be in place. Therefore, it is considered that the effect will be **neutral** which is **not significant**.
- 21.8.28 The geology and soils beneath the Site are unlikely to be receptors during the operational stage as the Site will be covered in hardstanding and site drainage will have been designed which will remove the pathway in the pollutant linkage. The effect is considered to be **neutral** which is **not significant**.

Migration and accumulation of ground gas

- 21.8.29 During operation ground gas may accumulate and migrate beneath the structures built within the Site due to the presence of Made Ground, warp and organic deposits and bedrock beneath the Site and landfills in the vicinity of the Site. However, standard and embedded mitigation measures will mean that the effect is considered to be **neutral** which is **not significant**.

Vertical and lateral migration of contaminants via groundwater and surface run-off

- 21.8.30 There is potential for accidental spillages and leakages from the handling of fuels, lubricants, stored chemicals and process liquids and infrastructure on the Site (pipelines, tanks and storage facilities) during the operational phase which may affect groundwater and surface water via surface run-off and lateral and vertical migration if appropriate mitigation measures are not applied. However, the Site will be operated in accordance with standard and embedded mitigation practices to control any likely impacts. Therefore, the effect is considered to be **neutral** which is **not significant**.

Decommissioning Impacts and Effects

- 21.8.31 This section contains an assessment of the likely impacts of the decommissioning phase of the hydrogen production facility on the Project.
- 21.8.32 The following impact pathways have been assessed prior to the implementation of mitigation measures:
- Direct contact with contamination.
 - Inhalation of dust and/or soil derived vapours.
 - Vertical and lateral migration of contaminants via groundwater and surface run-off.

Direct contact with contamination and inhalation of dust / soil derived vapours and ground gas

- 21.8.33 Human health receptors (future on site workers and site visitors) may be affected during the decommissioning stage if the ground is broken to remove the above ground structures on the Site. If there is any contamination beneath the Site, the decommissioning works may result in the removal, relocation or mobilisation of existing potential contaminants which could have an adverse effect on human health. However, the Site will be operated in accordance with standard and embedded mitigation controls which will result in a **slight adverse** effect which is **not significant**.
- 21.8.34 The breaking of ground during the decommissioning phase may result in the creation of new Source-Pathway-Receptor linkages which may have an adverse impact on the geology and soils underlying the Site. If there are any contaminants on the Site, the breaking of ground to remove above ground structures may result in the mobilisation of contaminants. Heavy plant and machinery and vehicle movements may degrade the soils on the Site. However, this is considered unlikely as any effects on the soils would have occurred during

the construction of the Project. Furthermore, the Site will be operated in accordance with standard and embedded mitigation controls and the effect is considered to be **slight adverse** which is **not significant**.

Vertical and lateral migration of contaminants via groundwater and surface run-off.

- 21.8.35 Following the Ground Investigation, it is concluded that where piling or other deep foundations or a form of ground improvement is to take place, the detailed construction methodology will be assessed to reduce the risk of the development of preferential pathways (e.g. groundwater flow) between the Made Ground present and the underlying Secondary superficial aquifers and Principal bedrock aquifers. Through standard and embedded mitigation practices it is considered that there will be a **slight adverse** effect which is **not significant**.
- 21.8.36 There is potential for accidental spillages and leakages from plant and machinery, as well as fuels, stored chemicals, process liquids and lubricants that are stored and used on Site during the decommissioning phase. These may migrate via surface run-off and lateral and vertical migration to surface water receptors and groundwater receptors respectively. However, the Site will be operated in accordance with standard and embedded mitigation practices and the effect will be **slight adverse** which is **not significant**.
- 21.8.37 The removal of structures on the Site may require dewatering, which could have an adverse effect on the hydrogeological regime, such as the lowering of groundwater. However, the Site will be operated in accordance with standard and embedded mitigation practices and controls which will result in a **slight adverse** effect which is considered **not significant**.
- 21.8.38 During the decommissioning stage, there is potential for run-off associated with stockpiled material that is not covered, migrating to nearby surface watercourses and groundwater beneath the Site. However, the Site will be operated in accordance with standard and embedded mitigation measures which will have a **slight adverse** effect which is considered **not significant**.

21.9 Mitigation and Enhancement Measures

- 21.9.1 The assessment presented in **Section 21.8** has indicated there is a slight adverse effect with regards to the loss of agricultural grade 3b soils within the West Site (Work No. 7) as a result of the Project, however the soil loss is already assumed with the cessation of the agricultural use and through the change of land use. The assessment has indicated that no other significant effects with regards to ground conditions and land quality are anticipated and therefore, no additional mitigation, monitoring or enhancement measures other than those set out in **Section 21.7** are considered necessary.

21.10 Assessment of Residual Effects

- 21.10.1 Based upon the assessment as detailed in **Section 21.8**, there are no significant residual effects anticipated with regards to human health, geology, soils, groundwater and surface water receptors.

21.11 Summary of Assessment

21.11.1 In summary, the likely receptors of the Project include human health, geology, soils and controlled waters.

21.11.2 The assessment demonstrates that the construction phase, operational phase and decommissioning phase will result in no significant effects. A summary of the ground condition and land quality impacts, mitigation measures and residual effects is provided in **Table 21-19**.

Table 21-19: Summary of impact pathways, mitigation measures and residual effects

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Construction Phase						
Human Health Onsite workers Site visitors Residents	Direct contact with contaminated soils, exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Construction works will be carried out in accordance with the CEMP, site specific health and safety legislation and regulations and general best practice guidance. Workers will be required to wear PPE. Asbestos has been encountered during the GI. An Outline AMP has been prepared as part of this ES. The Ground Investigation data has been used to inform land contamination risk assessments. An Outline Remediation Strategy [TR030008/APP/6.4] has been prepared to define mitigation measures for significant contamination and will outline how earthworks will be undertaken. An MMP will also be implemented to classify, track, store, dispose and potentially re-use excavated materials encountered.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Human Health Offsite workers Site visitors Residents	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Construction works will be carried out in accordance with the CEMP, site specific health and safety legislation and regulations. Works will also adhere to general best practice guidance such as “Environmental Good Practice on Site”, 3rd Edition, CIRIA Publication C762 (Ref 21-29) to minimise dust generation off-site. The Ground Investigation data has been used to inform land contamination risk assessments. An Outline Remediation Strategy has been prepared to define mitigation measures for significant contamination and outlines how earthworks will be undertaken. An Outline AMP has been prepared as part of this ES. An MMP will also be implemented to classify, track, store, dispose and potentially re-use excavated materials encountered.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Geology Beach and Tidal Flat Deposits Tidal Flat Deposits	Piling foundations	Construction works will be carried out in accordance with the CEMP. The construction methodology will be assessed and Piling Risk Assessments will be prepared and implemented.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Devensian Till Flamborough Chalk Formation		Environmental good practice will be adhered to on site.				
Soils Beach and Tidal Flat Deposits Tidal Flat Deposits	Spoil arising from earthworks and excavations and degradation due to plant heavy plant machinery and vehicle movement. Loss of potential versatile agricultural land.	An ALC Survey has been undertaken. The survey indicates the West Site and a thin strip of land within the Laporte Road Temporary Construction Area (Work No. 9) is classified as ALC Grade 3b. The following standards will be adhered to during earthworks operations: with BS1997:2004 Eurocode 7 (Ref 21-27), BS16907-1 to 7:2018 Earthworks (Ref 21-26); BS6031:2009 Code of Practice for earthworks (Ref 21-27) and National Highways (NH) guidelines including DMRB Series 600 'Earthworks' (Ref 21-28). An Outline Remediation Strategy has been prepared and is provided as Appendix 21.C [TR030008/APP/6.4] . Any surplus material will be re-used where possible, subject to the requirements within the Remediation Strategy and the MMP.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Soils Agricultural soils (temporary use)	Temporary compaction of existing ALC Grade 3b soils within the Laporte Road Temporary Construction Area during construction, resulting from soil levelling/compaction operations, and from the storage of materials.	Application of breathable, heavy duty ground mat protection on top of levelled and compacted soils, prior to the laydown of materials.	Slight Adverse (Not significant)	N/A	Slight adverse (Not Significant)	High
Soils Agricultural soils (permanent loss)	Permanent loss of existing ALC Grade 3b soils within the West Site, Work Nos 7 (including 7A to 7D) during construction of the Hydrogen Production and Liquefaction, storage and tanker loading area	There are no mitigation measures for the permanent loss of soil resource	Slight Adverse (Not significant)	N/A	Slight adverse (Not Significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	and hydrogen refuelling station.					
<p>Groundwater (Superficial Contamination) Beach and Tidal Flat Deposits (Secondary Undifferentiated Aquifer)</p>	<p>Vertical and lateral migration of contaminants via groundwater and surface run-off associated with:</p> <p>Potential vertical migration of spills and leakages.</p> <p>Potential for contaminant mobilisation during construction.</p> <p>Potential for creation of new preferential pathways and contaminant pathways. This may arise from piling, exposure of soils, increased</p>	<p>The Ground Investigation has obtained geo-environmental data including groundwater levels and quality. The Ground Investigation data has informed the land contamination risk assessments. Marginal exceedances of the DWS were recorded in the East Site (Work No. 3, 4 and 5) for metals and inorganics within the Tidal Flat Deposits and Flamborough Chalk Formation. A potential risk to groundwater was identified associated with inorganics in groundwater, particularly for ammonium, nitrate, sodium and chloride within shallow groundwater. No exceedances were recorded in the West Site (Work No. 7). Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Any proposed piling works would be subject to foundation risk assessments (e.g., a Piling Risk Assessment) and should be undertaken in accordance with best practice guidance. Piling method statements should detail measures to</p>	<p>Neutral/Slight Adverse (Not significant)</p>	<p>N/A</p>	<p>Neutral / Slight Adverse (Not significant)</p>	<p>High</p>

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	rainwater infiltration due to ground cover changes and excavations.	protect the aquifer if there is potential to cause pollution. A hydrogeological assessment and a dewatering scheme will be applied and implemented if dewatering is required or trenchless techniques are required in high sensitivity groundwater environments.				
Groundwater (Bedrock Contamination) Flamborough Chalk Formation and Burnham Chalk Formation (Principal Aquifer)	Vertical and lateral migration of contaminants via groundwater and surface run-off associated with: Potential vertical migration of spills and leakages. Changes to the hydrogeological regime. Potential for contaminant mobilisation during construction.	The Ground Investigation has obtained geo-environmental data including groundwater levels and quality. The Ground Investigation data has informed the land contamination risk assessments. Marginal exceedances of the DWS were recorded in the East Site (Work No. 3, 4 and 5) for metals, TPH and PAHs. A potential risk to groundwater was identified associated with metals and inorganics in groundwater, particularly for ammonium, nitrate, sodium and chloride within the Flamborough Chalk Formation. No exceedances were recorded in the West Site (Work No. 7). Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Any proposed piling works would be subject to foundation risk	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	Potential for creation of new preferential pathways e.g. during piling.	assessments (e.g., a Piling Risk Assessment) and should be undertaken in accordance with best practice guidance. Piling method statements should detail measures to protect the aquifer if there is potential to cause pollution. A hydrogeological assessment and a dewatering scheme will be applied and implemented if dewatering is required or trenchless techniques are required in high sensitivity groundwater environments.				
Surface Water (Contamination) Humber Estuary	Potential for run-off associated with exposed ground and material stockpiles into the Humber Estuary. Surface run-off associated with spills and leakages from vehicles or stored materials into the Humber Estuary.	Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Stockpiled materials will be stored at a suitable distance from surface watercourses to prevent run-off and should be suitably covered or reseeded if the stockpiled materials are not used within three months. Washing of plant and materials will only be undertaken in controlled areas. Chapter 17 Marine Water and Sediment Quality and Chapter 18 Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2] discusses	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	Direct disturbance of the riverbed or bank.	further guidance relating to the control of water pollution from construction sites.				
Surface Water (Contamination) North Beck Drain (waterbody and catchment) including the Habrough Marsh Drain	Potential for run-off associated with exposed ground and material stockpiles. Surface run-off associated with spills and leakages from vehicles or stored materials into the North Beck Drain on the eastern perimeter of the Site and the Habrough Marsh Drain to the west of the Site. This may affect the wider North Beck Drain catchment.	Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Stockpiled materials will be stored at a suitable distance from surface watercourses to prevent run-off and should be suitably covered or reseeded if the stockpiled materials are not used within three months. Washing of plant and materials will only be undertaken in controlled areas. Chapter 17: Marine Water and Sediment Quality and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2] discusses further guidance relating to the control of water pollution from construction sites.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Operational Phase						
Human Health (Contamination)	Exposure to contaminated	Operations will be required to comply with the relevant legislation and regulations, including	Neutral (Not significant)	N/A	Neutral (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Future on site workers	groundwater and exposure/inhalation of dust/soil derived vapours and ground gas.	the Environmental Permit, Hazardous Substance Consents, site and task specific health and safety documentation required for works undertaken at the Site. As a result, significant effects are considered to be unlikely. Workers will be required to use personal protective equipment prior to coming onto Site and will comply with confined space legislation and assessments.				
Human Health (Contamination) Future site visitors Off-site workers	Exposure to contaminated groundwater and exposure/inhalation of dust/soil derived vapours and ground gas.	The human health of future site visitors and off-site workers does not require mitigation measures as the operation of the Project is unlikely to cause significant effects to off-site receptors. Compliance with the Environmental Permit, Hazardous Substance Consents, site and task specific health and safety documentation required for works undertaken at the Site will minimise any effects to off-site workers and future site visitors.	Neutral/Slight Adverse (Not significant)	N/A	Neutral / Slight Adverse (Not significant)	High
Geology (Contamination)	Exposure to potential contaminants arising from spillages and leakages on the Site	No mitigation measures are required as the Site will be covered in hardstanding / impermeable surfacing, and it is assumed that the Site will be	Neutral (Not significant)	N/A	Neutral (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Superficial Deposits and Bedrock	that migrate vertically into the geology underlying the Site.	operated in accordance with an Environmental Permit and Hazardous Substance Consents.				
Controlled Waters (Contamination) Superficial Secondary Aquifer Principal Bedrock Aquifer Humber Estuary North Beck Drain and wider catchment (including the Habrough Marsh Drain)	Surface run-off and lateral / vertical migration arising from potential accidental spillages and leakages from handling of fuels, lubricants, and stored chemicals. This may impact surface waters and groundwater.	The Project will be operated in accordance with an Environmental Permit, Hazardous Substance Consents and there will be a managed surface drainage system and bunding as part of the Project. Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2] discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses.	Neutral (Not significant)	N/A	Neutral (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Decommissioning Phase						
Human Health (Contamination) Future site workers	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours.	A DEMP will be prepared and implemented at the Site. Workers will comply with standard mitigation, use personal protective equipment and comply with site-specific health and safety assessments and legislation. It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Human Health (Contamination) Off-site workers Site visitors	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours.	A DEMP will be prepared and implemented at the Site. Workers will comply with general best practice on site, use personal protective equipment and comply with site-specific health and safety assessments and legislation. It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Geology (Contamination)	Exposure to potential contaminants arising	Works will comply with standard and embedded mitigation guidance and the DEMP for the Site.	Neutral Adverse (Not significant)	N/A	Neutral Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Superficial Deposits and Bedrock	from spillages and leakages on the Site that migrate vertically into the geology underlying the Site.	It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator.				
Controlled Waters (Contamination) Superficial Secondary Aquifer Principal Bedrock Aquifer Humber Estuary North Beck Drain and wider catchment (including the Habrough Marsh Drain)	Surface run-off and lateral / vertical migration arising from potential accidental spillages and leakages from handling of fuels, lubricants, stored chemicals may impact surface waters and groundwater.	Works will comply with standard and embedded guidance and the DEMP for the Site. Material stockpiles will be located a suitable distance from watercourses and will be suitably covered if not used within three months to prevent mobilisation and run-off. It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator	Neutral/Slight Adverse (Not significant)	N/A	Neutral / Slight Adverse (Not significant)	High

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