Immingham Green Energy Terminal

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume II – Main Report

Chapter 21: Ground Conditions and Land Quality

Associated British Ports

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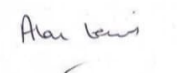
Signed		Date	20/12/2022
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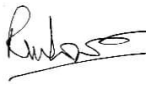
Signed		Date	20/12/2022
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21 Ground Conditions and Land Quality

21.1 Introduction

21.1.1 This chapter presents the preliminary findings of the Preliminary Environmental Information (PEI) assessment of the likely effects of the Project in relation to Ground Conditions and Land Quality.

21.1.2 There may be interrelationships related to the potential effects on Ground Conditions and Land Quality and other disciplines. Therefore, refer to the following chapters in Volume II of the PEI Report:

a. **Chapter 8: Nature Conservation (Terrestrial Ecology).**
b. **Chapter 9: Nature Conservation (Marine Ecology).**
c. **Chapter 10: Ornithology.**
d. **Chapter 16: Physical Processes.**
e. **Chapter 17: Marine Water and Sediment Quality.**
f. **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage.**
g. **Chapter 22: Major Accidents and Disasters.**

21.1.3 This chapter is also supported by the following figures contained in Volume III of the PEI Report:

a. **Figure 1.1** Site Location Plan;
b. **Figure 2.1** Site Plan;
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; and
h. **Figure 21.6** Source Protection Zones (including study area).

21.2 Approach to Assessment

Scope and Methods

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.

21.2.2 The Scoping Report (**Appendix 1.A** of PEI Report Volume IV) 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.

21.2.3 Following receipt of the Scoping Opinion (**Appendix 1.B** of PEI Report Volume IV) as to the information to be provided in the Environmental Statement (ES), the following requirements have been identified by the Planning Inspectorate which will be taken into account as part of the ongoing Ground Conditions and Land Quality assessment:

a. The Agricultural Land Classification (ALC) should be confirmed in the ES based on a recognised approach such as Natural England's Technical Information Note TIN049 Agricultural Land Classification: Protecting the best and most versatile agricultural land. The Planning Inspectorate recommend that the ES should demonstrate how areas of the best and most versatile land have been avoided in the proposed development. An ALC survey will be undertaken prior to the submission of the ES to confirm the subgrades of Grade 3 land and inform the assessment in the ES chapter; and

b. Guidance documents referred to for the assessment of Ground Conditions and Land Quality should include the following:

   i. 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;

   ii. Natural England (2012) Technical Information Note TIN049 Agricultural Land Classification: Protecting the best and most versatile agricultural land; and

   iii. Institute of Environmental Management and Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment.

21.2.4 Having regard to the information presented within the Scoping Report (**Appendix 1.A** of PEI Report Volume IV), the Planning Inspectorate's Scoping Opinion (**Appendix 1.B** of PEI Report Volume IV) has also confirmed the Applicant's view that significant effects on soil during the operational phase are unlikely as any potential impacts would have occurred during the construction phase. Accordingly, this matter will remain scoped out of consideration in the ES.

21.2.5 Consultation has been undertaken with the following stakeholders to discuss any further potential issues relating to ground conditions and land quality that may not be available within the public domain:

a. Environment Agency (EA);

b. Coal Authority;

c. Natural England;

d. English Heritage;

e. Immingham Town Council;

f. Lincolnshire Council;

g. North East Lincolnshire Council (NELC);

h. Crown Estate;

i. The Port Authority; and

j. Marine Management Organisation.

21.2.6 A summary of the scoping opinions received is provided in **Table 21.1.**

Table 21.1 Scoping Opinion Comments on ground conditions and land quality

Consultee	Summary of Response	How comments have been addressed in this chapter
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.	No response required
	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.	The ALC for the site is defined in the baseline section and an ALC survey is recommended in the PEI Report as part of the mitigation during the construction phase.
	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: •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., Gemmell, L., Adams, K. (eds) (2021) IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment.	The recommended guidance list has been added to the PEI Report and will be included and summarised in the ES.
Environment Agency	We have reviewed this chapter and can advise that we are satisfied with the scope	No response required

Consultee	Summary of Response	How comments have been addressed in this chapter
	and methodology proposed to assess ground conditions and land quality.	
The Coal Authority	The Coal Authority have 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 consider 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.	The response from the Coal Authority has been noted. **Paragraph 21.3.37** provides information on coal mining for the proposed development site boundary.
	It is recommended to include the following text if planning permission is granted as part of the formal application: "*The proposed development lies within a coal mining area which may contain unrecorded coal mining related hazards. If any coal mining feature is encountered during development, this should be reported immediately to the Coal Authority on 0345 762 6848"*.	The baseline section of the PEI Report provides information on the geology of the site. The chalk is at a significant thickness overlying potential coal measures, that works at this site are unlikely to impact Coal Authority Property. The recommended text will be added to the formal application if planning permission is granted and is also included in **paragraph 21.3.37**
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.	The baseline section of the PEI Report provides information on the ALC grading for the site and the soil chemistry in **Paragraphs 21.3.7** to **21.3.11**. The potential impact on soils is discussed in **Paragraphs 21.5.10** to **21.5.13** and summarised in **Table 21.11**. Mitigation measures for soils are summarised in **Section 21.4** including the requirement for an ALC survey prior to the submission of the ES to confirm the subgrades of Grade 3 ALC and inform the ES. Further mitigation measures include the use of a Remediation Strategy to facilitate the potential re-use of soil on site. The National Policy Statement that applies to the Project is the National Policy Statement for Ports which is summarised in **Table 21.5.**
	Natural England also note that the ES should discuss the potential for an increased pollution risk during the construction and	The assessment of significance of effects during the construction and operational phases considers the potential for an increased pollution risk in **Section 21.5.**

Consultee	Summary of Response	How comments have been addressed in this chapter
	operational phases of the proposed development.	
English Heritage	English Heritage have not provided a response to the Scoping Opinion.	No response required.
Immingham Town Council	Immingham Town Council have not provided comments in regard to Ground Conditions and Land Quality.	No response required.
Lincolnshire Council	Lincolnshire Council have not provided a response to the Scoping Opinion.	No response required.
NELC	In terms land quality (Section 20) NELC agree with the scope and methodology presented.	No response required.
Crown Estate	The Crown Estate have not provided a response to the Scoping Opinion.	No response required.
The Port Authority	The Port Authority have not provided a response to the Scoping Opinion.	No response required.
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 determinantal to land quality as well as the hydrology and neighbouring watercourses.	Operational mitigation measures, including appropriate emergency environmental management plans and procedures, are discussed in **Section 21.4.**

21.2.7 The assessment methodology for the PEI Report follows the methodology proposed in Section 20.6 of the Scoping Report (**Appendix 1.A** of PEI Report Volume IV). There are no changes proposed to the methodology within this PEI Report to that contained in the Scoping Report.

21.2.8 The assessment methodology diverges from the generic guidelines of sensitivity and magnitude of impact outlined in **Chapter 5: EIA Approach** of this PEI Report to follow the guidance in the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (Ref 21-1) and DMRB LA 113 Road Drainage and the Water Environment (Ref 21-2).

21.2.9 The sensitivity of the receptor reflects the quality of receptor and its ability to absorb an effect without perceptible change. The sensitivity of the receptor is defined using DMRB LA 113 is outlined in **Table 21.2.**

Table 21.2: Sensitivity of Receptors

Sensitivity / Value	Description Criteria	Typical Examples
Very High	Geology Very rare and of international importance with no potential for replacement.	UNESCO World Heritage Sites SSSIs and GCR of international importance and or UNESCO Global Geoparks.
	Soils Soils directly supporting an EU designated site or agricultural land.	SAC, SPA, Ramsar; and/ or ALC Grade 1 and 2 or LCA Grade 1 and 2
	Contamination Human health: very high sensitivity.	Very high sensitivity land use (e.g. residential).
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Watercourse having a WFD classification shown in a RBMP and Q95 ≥ 1. 0 m^3/ s. Site protected/ designated under EC or UK legislation (SAC, SPA, SSSI) Ramsar site, salmonid water/species protected by EC legislation.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Principal aquifer providing a regionally important resource and/ or supporting a site protected under EC and UK legislation Groundwater locally supports GWDTE SPZ1
High	Geology Rare and of national importance with little potential for replacement.	Rare and of national importance with little potential for replacement (e.g. geological SSSI, ASSI, National Nature Reserves (NNR)). Geology meeting national designation citation criteria which is not designated as such.
	Soils 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.
	Contamination Human health: very high sensitivity;	High sensitivity land use such as public open space.
	Surface water	Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m^3/ s.

Sensitivity / Value	Description Criteria	Typical Examples
	Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Species protected under EC or UK legislation.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE. SPZ2.
Medium	Geology Of regional importance with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	Local Geological Sites (formerly RIGS)
	Soils Soils supporting non-statutory designated sites.	Local Nature Reserves (LNR), LGS's, Sites of Nature Conservation Importance (SNCIs); and/ or ALC Grade 3b or LCA Grade 3.2.
	Contamination Human health: medium sensitivity;	Medium sensitivity land use such as commercial or industrial.
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Watercourses not having a WFD classification shown in a RBMP and Q9 5 >0.001m^3/ s.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3
Low	Geology Of local importance/ interest with potential for replacement	Non designated geological exposures, former quarry's/ mining sites
	Soils Soils supporting non-designated notable or priority habitats	ALC Grade 4 and 5 or LCA Grade 4.1 to 7

Sensitivity / Value	Description Criteria	Typical Examples
	Contamination Human health: Low sensitivity;	Low sensitivity land use such as highways and rail.
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Watercourses not having a WFD classification shown in a RBMP and Q9 5 ≤0.001m^3/ s.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment LA113.	Unproductive strata
Negligible	Geology No geological exposures, little/ no local interest.	
	Soils Previously developed land formerly in 'hard uses' with little potential to return to agriculture.	
	Contamination Human health: Undeveloped surplus land/ no sensitive land use proposed.	
	Surface water and groundwater There is no sensitivity rating for negligible described in LA113.	

21.2.10 The magnitude of a potential impacts considers the scale of the predicted change to the baseline condition taking into account its duration (i.e. the magnitude may be moderated if they are temporary rather than permanent, short term rather than long term). The magnitude of impact is defined using DMRB LA 113 and DMRB LA 100 as outlined in **Table 21.3.**

Table 21.3: Magnitude of Impacts

Magnitude	Criteria	Typical Examples
Major (LA109)	Geology 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.
	Soils Physical removal or permanent sealing of soil resource or agricultural land.	N/A
	Contamination Human Health: significant contamination identified.	Contamination levels significantly exceed background levels and relevant screening criteria (e.g.: category 4 screening levels) SP1010 with potential for significant harm to human health. Contamination heavily restricts future use of land.
Major adverse (LA113)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT and compliance failure with EQS values. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff - risk

Magnitude	Criteria	Typical Examples
		score >250 (Groundwater quality and runoff assessment). Calculated risk of pollution from spillages ≥2% annually (spillage assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss or significant damage to major structures through subsidence or similar effects.
Major Beneficial (LA113)	-	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
		Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.
Moderate (LA109)	<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; National Nature Reserves.
	<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	Significant contamination can be present. Control/ remediation measures are required to reduce risks to human health/ make land suitable for intended use.

Magnitude	Criteria	Typical Examples
	(e.g. category 4 screening levels) SP1010.	
Moderate adverse (LA113)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥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.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	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. Calculated risk of pollution from spillages ≥1% annually and <2 % annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.
Moderate beneficial (LA113)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually). Contribution to improvement in water body WFD classification.

Magnitude	Criteria	Typical Examples
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually). Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE.
Minor (LA109)	Geology 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.	Minor measurable change of features at Geological sites; i.e. RIGS.
	Soils Temporary loss/ reduction of one or more soil function(s) and restriction to current or approved future use.	Through degradation, compaction, erosion of soil resource.
	Contamination Human health: contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels) SP1010.	Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health.
Minor adverse (LA113)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and < 1% annually. Minor effects on water supplies.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	Potential low risk of pollution. to groundwater from routine runoff - risk score <150 Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on an aquifer, GWDTEs, abstractions and structures.
Minor beneficial (LA113)	Surface water: relevant sensitivity criteria from Table 3.71 in Road	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing

Magnitude	Criteria	Typical Examples
	drainage and water environment LA113.	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).
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	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 (LA109)	Geology 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.
	Soils No discernible loss/ reduction of soil function(s) that restrict current or approved future use.	N/A
	Contamination 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 (LA113)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113.	No measurable impact upon an aquifer and/ or groundwater receptors and risk of pollution from spillages <0.5%.

21.2.11 The significance of effect matrix diverges from the generic significance evaluation matrix provided in **Chapter 5: EIA Approach** to follow the guidance in DMRB LA 104 (Ref 21-3). **Table 21.4** provides a summary of the significance of effect matrix.

Table 21.4.Significance Evaluation Matrix

		Magnitude of Change (degree of change)				
		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 two significance categories are given, evidence should be provided to support the reporting of a single significance category.						

Legislation, Policy and Guidance

21.2.12 **Table 21.5** presents the legislation, policy and guidance relevant to the Ground Conditions and Land Quality assessment and details how their requirements will be met in the assessment. The North Lincolnshire Plan was previously included in the Scoping Report. However, the Order Limits is not located within the boundary of North Lincolnshire Council (NLC). Therefore, the local plan has not been summarised in **Table 21.5**.

Table 21.5 Relevant legislation, policy and guidance regarding Ground Conditions and Land Quality Chapter

Legislation / Policy / Guidance	Consideration within the PEI Report
EU Legislation Although the UK left the EU on 31 January 2020, the legislation in this section has been adopted by the UK and remains applicable to the assessments in this PEI Report, as summarised in **Chapter 4: Legislative and Consenting Framework**.	
The Water Framework Directive (2000/60/EC) (Ref 21-37)	
The framework for community action in the field of water policy. The principal objective of the 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	The WFD surface water bodies are described in **Paragraphs 21.3.47** and **21.3.48**. The potential impact to the WFD surface water bodies is outlined in **Sections 21.5** and **21.6**.

Legislation / Policy / Guidance	Consideration within the PEI Report
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 *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 21-38).*	
The Groundwater Directive (2006/118/EC) (Ref 21-39)	
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 *Water Framework Directive (2000/60/EC)*. This is transposed into UK law by *The Groundwater (Water Framework Directive) (England) Direction 2016* (Ref 21-40) and *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017* (Ref 21-38).	The WFD groundwater bodies are described in **Paragraph 21.3.39**. The potential impact to groundwater is outlined in **Sections 21.5** and **21.6**.
The Environmental Liability Directive (2004/35/EC) (Ref 21-41)	
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 to the cost of prevention measures and remediation strategies. This is transposed into UK law by *The Environmental Damage (Prevention and Remediation) (England) (Amendment) Regulations 2019* (Ref 21-42).	Mitigation measures to prevent environmental damage are discussed in **Section 21.4**.
Classification Labelling & Packaging (CLP) Regulation (2008/1272/EC) (Ref 21-43), superseding *The Dangerous Substances Directive (67/548/EEC)* in 2016	
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 *The Classification, Labelling and Packaging of Chemicals (Amendments to Secondary Legislation) Regulations 2015* (Ref 21-45).	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 are discussed in **Sections 21.5** and **21.6**.The mitigation measures are discussed in **Section 21.4**.

Legislation / Policy / Guidance	Consideration within the PEI Report
The Priority Substances Directive (2008/105/EC) (Ref 21-46)	
The Directive is part of EU legislation and 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 *The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015* (Ref 21-47).	The WFD surface water bodies are described in **Paragraphs 21.3.47** and **21.3.48**. The WFD groundwater bodies are described in **Paragraph 21.3.39**. The potential impact to the WFD surface water bodies and groundwater bodies are outlined in **Sections 21.5** and **21.6**.
UK Legislation	
Environmental Protection Act, 1990 (Ref 21-48)	
Part 2A of the *Environmental Protection Act 1990* 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.	The potential impacts to human health and the environment are outlined in **Sections 21.5** and **21.6**.
The Environment Act 1995 (Ref 21-49)	
The Act established the Environment Agency (EA) and Scottish Environment Protection Agency (SEPA) as corporate bodies. This makes provision with respect to contaminated land and abandoned mines. Further provisions are provided for National Parks, pollution controls, natural resource conservation and environment conservation/enhancement.	The potential impacts to the environment from the Project are outlined in **Sections 21.5** and **21.6.**
The Environment Act 2021 (Ref 21-50)	
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.	Mitigation measures to protect the environment as part of the proposed development are outlined in **Section 21.4**.
The Contaminated Land (England) (Amendment) Regulations 2012 (Ref 21-51)	
The Regulations set out the processes of risk assessment and identification/evaluation of remediation options. This is an amendment of the *Contaminated Land (England) Regulations, 2006 (Ref 21-52)*.	The potential sources, pathways and receptors are outlined in **Paragraphs 21.3.59** to **21.3.61**, and the potential impacts to the receptors are discussed in **Sections 21.5** and **21.6**.
Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref 21-53)	

Legislation / Policy / Guidance	Consideration within the PEI Report
The Regulations describes the legal framework for the prevention of environmental damage and requirements for remediation of damage when it occurs. It sets out the UK Government views on how they should be applied and how particular terms should be interpreted.	Mitigation measures to mitigate and reduce the potential impact to the environment are discussed in **Section 21.4**.
The Water Act 2003 (Ref 21-54)	
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 controlled waters pollution and coal mine water discharge and describes provisions for land drainage and flood defence. This was issued to amend the *Water Resources Act 1991* (Ref 21-55) and *Water Industry Act 1991* (Ref 21-56).	Groundwater and surface water abstractions within a 1km radius from the Order Limits are described in **Paragraphs 21.3.45**, **21.3.46** and **21.3.50**.
The Water Act 2014 (Ref 21-57)	
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 describes 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.	Groundwater and surface water abstractions within a 1km radius from the Order Limits are described in **Paragraphs 21.3.45**, **21.3.46** and **21.3.50**.
The Environmental Permitting (England and Wales) Regulations 2016 (as amended) (Ref 21-58)	
Previously under the Water Resources Act 1991 (Ref 21-55) and now under the *Environmental Permitting (England and Wales) Regulations* *(as amended)* it is an offence for a person to fail to comply with or to contravene an environmental permit. The Act provides a framework for the application of environmental permits as well as receiving, varying, transferring and surrendering permits and compliance / enforcement of permits.	Controlled waters are discussed in **Paragraphs 21.3.38** to **21.3.50**. The potential impacts to controlled waters are discussed in **Sections 21.5** and **21.6**. Mitigation measures for controlled waters are described in **Section 21.4**.
The Land Drainage Act 1991 (as amended) (Ref 21-59)	
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.	Information on drainage on the site is provided in **Paragraph 21.3.47**. Potential impacts to the drainage on the site and in the study area is discussed in **Sections 21.5** and **21.6**. Mitigation measures to protect controlled waters, including drainage, are presented in **Section 21.4**.

Legislation / Policy / Guidance	Consideration within the PEI Report
	Further information is also provided in Chapter 18 Water Quality, Coastal Protection, Flood Risk and Drainage.
The Water Environment (Water Framework Directive) Regulations 2017 (Ref 21-38)	
The Water Environment Regulations 2017 aims to implement the WFD and Groundwater Directive.	The WFD surface water and groundwater bodies are discussed in **Paragraphs 21.3.39**, **21.3.47** and **21.3.48**. The potential impact to surface water and groundwater are discussed in **Sections 21.5** and **21.6**.
The Waste (England and Wales) Regulations 2011 (as amended) (Ref 21-60)	
The Regulations set out the measures required for the prevention of, production and management of waste. This describes the purpose of a waste prevention program with waste prevention measures and makes reference to monitoring by appropriate authorities using qualitative or quantitative benchmarks.	The management of waste produced on site is discussed in **Paragraphs 21.4.4** and **21.4.5**.
National Policy	
National Policy Statement for Ports (NPSfP) (Ref 21-61)	
The NPSfP is a framework to address proposals for port development in the UK and associated development (rail and road). This describes the UK Government's conclusions on new port infrastructure in the context of future demand and needs and the current economy. The Project consisting of a liquid bulk import terminal and processing facility in the port is considered to be an NSIP within the ports industry. This Policy Statement contains the following relevant policies: Section 4.7 describes the requirements for an Environmental Impact Assessment and states that "*projects that are subject to the European Environmental Impact Assessment Directive must be accompanied by an Environmental Statement (ES) describing the aspects of the environment likely to be significantly affected by the project*". The effects on human health, water, soil, cultural heritage, material assets, climate, the landscape and flora and fauna should be assessed.	Provides general guidance.
Section 4.11 concerns pollution control and environmental regulations that need to be considered. This describes the requirement for pollution control measures and recommends consultation and contact with the EA to determine potential effects, environmental permits and other consents.	Provides general guidance.

Legislation / Policy / Guidance	Consideration within the PEI Report
Paragraph 4.11.3 notes that the decision-maker should consider the development in the context of the land use as opposed to measures to control processes, discharges and emissions. It is stated that *"the decision-maker should work on the assumption that the relevant pollution control regime, other environmental regulatory regimes, including those on land drainage, water abstraction and biodiversity will be properly applied and enforced by the relevant regulator".*	
Section 4.16 refers to the impact of ports on human health, with direct reference to polluting water and hazardous waste. Paragraph 4.16.2 suggests health impacts should be identified.	The potential impacts on human health and controlled waters are described in **Sections 21.5** and **21.6**.
Section 5.1 refers to the impacts on biodiversity and geological conservation. As part of this, paragraph 5.1.3 describes the adverse impacts including spillages or leakages from cargo handling and storage that could result in water pollution and contamination.	There are no geological conservation sites within the study area, as described in **Paragraph 21.3.21**. The potential adverse impacts on geology and controlled waters are described in **Sections 21.5** and **21.6**.
Section 5.6 refers to water quality and resources. In particular, paragraph 5.6.2 refers to the risk of pollutants entering the water due to spills and leaks from the development.	The risk of pollutants entering the water due to spillages and leakages are described in **Sections 21.5** and **21.6**. Mitigation measures for the proposed development are described in **Section 21.4**.
Section 5.13 refers to land use and in particular, paragraph 5.13.8 describes how the risks associated with land contamination should be considered when land has previously been developed.	The baseline conditions, including potential sources of contamination, are described in **Section 21.3**. The potential impact to the proposed development is described in **Sections 21.5** and **21.6**.
National Planning Policy Framework (NPPF) (Ref 21-62)	
The NPPF sets out the government's planning policies for England and how these are expected to be applied. This Framework contains policies relevant to the geology and soils assessment. Paragraph 120 c) describes how "*planning policies and decisions should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*".	Provides general guidance.
Paragraph 174b relates to contributing to and enhancing the local environment through recognising the benefits of natural capital, ecosystem services, agricultural land, trees and woodland.	Provides general guidance.

Legislation / Policy / Guidance	Consideration within the PEI Report
Paragraphs 183 – 188 form part of a section called 'Ground conditions and pollution'.	The baseline in **Section 21.3** outlines the ground conditions at the site and provides information on potential sources of contamination within the study area for the Project.
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. This requires that land cannot be classified as contaminated post remediation as defined under Part IIA of the *Environmental Protection Act 1990*.	**Section 21.3** provides the baseline for ground conditions, including reference to land instability and potential sources of contamination. A site investigation is proposed to be undertaken, as described in **Paragraphs 21.2.17, 21.4.3 and 21.4.8**.
Paragraph 184 relates to the responsibility of developers and/or landowners for safe development.	Provides general guidance.
Paragraph 185 refers to minimising the effects of pollution and adverse impacts from the Project.	Mitigation measures for the Project are described in **Section 21.4** and summarised in **paragraphs 21.4.3 to 21.4.14** for the construction phase, **21.4.15 to 21.4.17** for the operational phase and **21.4.18 to 21.4.20** for the decommissioning phase.
Local Policy	
Northeast Lincolnshire Council Local Plan (Ref 21-63)	
The following policies of the NELC Local Plan are relevant to the ground conditions and land quality assessment: Policy 34: Water management. This policy outlines the requirements of development proposals in relation 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.	Information on controlled waters is provided in the baseline in **Paragraphs 21.3.38** and **21.3.46**. Mitigation measures to protect controlled waters during the construction, operational and decommissioning phases is provided in **Section 21.4**.
Policy 40: Developing a green infrastructure network. This policy outlines the importance of green spaces and infrastructure within developments, as well as biodiversity, climate change mitigation and sustainable water management. As part of this Policy, open areas between Immingham and the northern industrial development will be given specific protection.	Provides general guidance.
Policy 41: Biodiversity and Geodiversity. This policy aims to retain, protect and restore biodiversity value and the ecological network. The protection and enhancement of	Designated geological sites are described in **Paragraph 21.3.4**. The potential impact to geology and controlled waters, including

Legislation / Policy / Guidance	Consideration within the PEI Report
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.	the Humber Estuary, are described in **Section 21.5 and 21.6**.
Policy 46: Restoration and Aftercare (minerals). This policy refers to mineral development applications which should minimise disturbance and restore land as early as possible.	Provides general guidance.
Policy 49: Restoration and Aftercare (waste). This policy refers to proposals for additional landfill that should minimise disturbance and restore the land as early as possible.	Provides general guidance.
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 21-64).	
The document provides guidance on the grading of agricultural land as part of the Agricultural Land Classification (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. The ALC is divided into five grades from 1 to 5, with Grade 3 separated into subgrades 3a and 3b: • 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; • 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. It is considered that Grade Urban land will be unlikely to return to an agricultural land use.	The ALC for the site is described in **paragraphs 21.3.9** to **21.3.11** and the recommendation for an ALC survey is discussed in **paragraph 21.4.13**.

Legislation / Policy / Guidance	Consideration within the PEI Report
Natural England (2012) Technical Information Note TIN049 Agricultural Land Classification: Protecting the best and most versatile agricultural land (Ref 21-65)	
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.	The ALC for the site is described in **paragraphs 21.3.9** to **21.3.11** and the recommendation for an ALC survey is discussed in **paragraph 21.4.13**.
IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (Ref 21-66)	
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.	The soil classification is described in **Paragraph 21.3.7** and the soil chemistry is described in **Paragraph 21.3.8**. The impact on the soil within the site boundary is summarised in **Table 21.11.**

Stakeholder Engagement

21.2.13 A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Project and the scope of the Ground Conditions and Land Quality assessment, the results of which are presented within the Scoping Opinion (**Appendix 1.B** of the PEI Report Volume IV).

Limitations and Assumptions

21.2.14 The information presented in this preliminary assessment reflects that obtained and evaluated at the time of reporting, and is based on an emerging design for the Project and the maximum likely extents of land required for its construction and operation in accordance with the principles of the Rochdale Envelope.

21.2.15 The assessment undertaken during the PEI Report has been based on the collation and evaluation of available information obtained from the British Geological Survey (BGS), Groundsure Report and other sources made available.

21.2.16 Site specific Ground Investigation (GI) information is not yet available for the Project.

21.2.17 Prior to the development of the ES, a GI will be undertaken to assess the presence of contamination on site and determine the impacts this may have on site users and the environment. The findings will feed into the identification of mitigation measures, which may include remediation, the detailed design process and Construction Environmental Management Plan (CEMP) of the Project so that appropriate measures are taken.

21.2.18 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 EA, where risks to controlled waters are identified. Any

remedial measures will be outlined within a Remediation Strategy developed in parallel with the ES and CEMP which will be submitted for DCO examination.

21.2.19 The findings of this preliminary assessment may be subject to change as the design of the Project is developed and refined further through the assessment and consultation processes, and as further research and investigative surveys are completed to fully understand its potential effects.

21.2.20 The findings from further investigation will be used to re-evaluate the assessment of ground conditions and land quality within the ES.

Study Area

21.2.21 The study area for the assessment is defined as the area over which potential direct and indirect effects of the Project are predicted to occur during the construction and operational periods.

21.2.22 Direct effects on ground conditions are considered to be those that may arise through the accidental release of contaminants during construction and / or operation.

21.2.23 Indirect effects are considered to involve the disturbance of the ground in such a way that contaminant linkages (source-pathway-receptor) are created. For example, hypothetically introducing a new pathway for the migration of a pollution plume within the Made Ground into aquifers or by allowing potentially contaminated dusts, during construction, to migrate offsite to nearby residential and/or commercial properties.

21.2.24 As stated in the Scoping Report (**Appendix 1.A** of the PEI Report Volume IV), the study area for the ground conditions and land quality topic is defined as the entirety of the ground within the Project Site boundary, along with a buffer extending 500m around the Site in order to identify potential off-site source of contamination and land stability issues to inform the baseline conditions within and adjacent to the Site. This includes the artificial land, geological deposits underlying artificial ground and any natural ground underlying surface water bodies within the area of the Site. For assessment of effects to controlled waters including groundwater abstractions and groundwater source protection zones a buffer extending 1 km from the Site boundary is considered appropriate. The Site location is shown on **Figure 1.1** and **Figure 2.1** (PEI Report Volume III) shows the indicative site plan for the Project, outlining the location of the West Site, Pipeline, East Site, Temporary Construction Area and Jetty areas of the Site.

21.3 Baseline Conditions

Current Baseline

21.3.1 The baseline conditions established for this assessment are based on a review of a wide range of data and information from published material from the following sources:

a. BGS GeoIndex Online (Ref 21-1);

b. British Geological Survey Solid and Drift for Partington (Sheet 81 (and including parts of Sheet 82 and 90) 1:50,000 (Ref 21-5);

c. British Geological Survey Lexicon of Named Rock Units (Ref 21-6, Ref 21-7, Ref 21-8 and Ref 21-9);

d. Cranfield Soil and Agrifood Institute Soilscapes (Ref 21-10);

e. Coal Authority Interactive Map Viewer (Ref 21-11);

f. Defra's MAGIC website (Ref 21-12);

g. Environment Agency Catchment Data Explorer (Ref 21-13);

h. Google Maps website (Ref 21-14); and

i. Groundsure Report Enviro+Geo Insight Report (GS-9009838) (Ref 21-15).

21.3.2 The following baseline conditions comprises a summary of the entire Project site using information from the sources listed in **Paragraph 21.3.1**.

21.3.3 Previous GI has been undertaken at the Site within the West Site and the southern area of the East Site. Additional intrusive investigations at the Site are proposed to be undertaken to inform detailed design and will also be used to support the assessment within the ES. Following the completion of the GI works, the baseline description will be updated, and the assessment of ground conditions and land quality will be completed as part of the ES. The objective of the GI will be to obtain sufficient chemical and geotechnical data, via site and laboratory testing, from across the site to be able to further develop a Conceptual Site Model (CSM) and that there is adequate, good quality data available for undertaking human health, controlled waters and ground gas risk assessments.

Statutory and Non-Statutory Designed Sites

21.3.4 The Humber Estuary is designated as a Ramsar site; a Site of Special Scientific Interest (SSSI); a Special Area of Conservation (SAC) and a Special Protection Area (SPA).

21.3.5 The Groundsure Report (GS-9009838) (Ref 21-15) indicates the green hydrogen production facility infrastructure of the Project site is located within a SSSI Impact Risk Zone and the bank of the Humber Estuary within the site boundary is classified as 'unfavourable – recovering'.

21.3.6 The green hydrogen production facility infrastructure of the site is within a Nitrate Vulnerable Zone associated with the North Beck Drain, as shown on **Figure 21.3** (PEI Report Volume III).

Soils

21.3.7 Cranfield Soilscapes (Ref 21-10) describes the soils beneath the entire Site as "*loamy and clayey soils of coastal flats with naturally high groundwater*", with naturally wet drainage and lime rich to moderate fertility. It is noted that the "*water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to the land*".

21.3.8 The BGS Estimated Background Soil Chemistry for the entire Site is recorded as the following in the Groundsure Report (GS-9009838) (Ref 21-15):

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

East Site – Agricultural Land Classification

21.3.9 The Provisional Agricultural Land Classification Grade map on the MAGIC Map Application (Ref 21-17) indicates the East Site is designated as Grade Urban.

West Site – Agricultural Land Classification

21.1.2 The Provisional Agricultural Land Classification Grade map on the MAGIC Map Application (Ref 21-17) indicates that 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.

Pipeline– Agricultural Land Classification

21.3.10 The Provisional Agricultural Land Classification Grade map on the MAGIC Map Application (Ref 21-17) indicates the Pipeline land is designated as Grade Urban.

Temporary Construction Area (northeast) – Agricultural Land Classification

21.3.11 The Provisional Agricultural Land Classification Grade map on the MAGIC Map Application (Ref 21-17) indicates the eastern half of the 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.

Geology

21.3.12 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 21-5) and on the 1:50,000 Geology Maps provided as part of the Groundsure Report (GS-9009838) (Ref 21-15).

21.3.13 **Table 21.6** 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 21-6, Ref 21-7, Ref 21-8 and Ref 21-9). **Figures 21.1** and **21.2** (PEI Report Volume III) demonstrate the geology beneath the Site.

Table 21.6: Geology

Stratum		Expected Location	Description (BGS Lexicon)
Artificial	Made Ground (Undivided) Artificial Deposit	Made Ground (Undivided) is shown on the BGS GeoIndex in the western half of the East Site and in the central area of the Pipeline route. Although it is not mapped across most of the Site, Made Ground is anticipated to be present across the majority of the green hydrogen production facility 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 green hydrogen production facility (Pipeline and Temporary Construction Area in the northeast) of the Site, 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 (BGS, 2022) indicates the Flamborough Chalk Formation is present beneath the entire Site, underlying the Devensian Till. However, the BGS Sheet 81 for Patrington 1:50,000 Map (BGS, 1991) indicates that the Flamborough Chalk Formation is present	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)
		across most of the Site, apart from a thin strip along the western boundary of the West Site.	
	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.	The Burnham Chalk Formation is described as "*white, thinly-bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams*".

21.3.14 The Groundsure Report (GS-9009838) (Ref 21-15) 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, and 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.

21.3.15 There are seventeen BGS boreholes located within the Site boundary, or within 5m of the Site boundary. Of the seventeen 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 is provided in **Table 21.7**.

Table 21.7: Summary of encountered strata in BGS boreholes

Strata	Minimum Depth (m bgl)	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater
West Site				
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*	-

Strata	Minimum Depth (m bgl)	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater
Boulder Clay	7.77	18	2.89 – 7.17	-
Sand	10.97	11.58	0.61*	-
Chalk***	15.24	25.3**	3.28** – 4.88**	-
Pipeline Area				
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				
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**	-
Northeast Temporary Construction Area*				

Strata	Minimum Depth (m bgl)	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater
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**	-

**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 21-36), 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.*

Ground Stability Hazards

21.3.16 The Groundsure Report (GS-9009838) (Ref 21-15) presents information of the ground stability hazards at the Site.

21.3.17 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.

21.3.18 The areas of the Site that are mapped as Made Ground on the BGS 1:50,000 Artificial Map 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.

21.3.19 The entire Site has been classified as a *Negligible* risk for collapsible ground stability hazards and ground dissolution hazards.

21.3.20 The entire Site has been classified as a *Very Low* risk associated with landslide ground stability hazards.

Geological Features

21.3.21 There are no faults within the Site, or within 1km from the Site. There are no Regionally Important Geological Sites (RIGS) or Local Geological Sites within the Site boundary.

Previous Ground Investigations – Pipeline area

21.3.22 A GI was undertaken in the Pipeline area in November 2020 by RSK (Ref 21-19). At the time of the site investigation, the Project was anticipated to comprise of a cold fridge store, two-storey modular office unit, heavy goods vehicle (HGV) parking facilities, dock levellers and a services compound.

21.3.23 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 between November and December 2020. Chemical and geotechnical laboratory analysis was also undertaken.

21.3.24 The following strata was encountered:

a. Topsoil at ground level, with a thickness of 0.1m;

b. Made Ground at ground level, with a thickness of 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;

c. Tidal Flat Deposits with a thickness of 7.95m to 8.3m. The depth to the top of the Tidal Flat Deposits was recorded between 0.1m bgl and 2.4m bgl. 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 9.75m bgl, and 10m bgl and 10.45m bgl in BH01;

d. Glacial Till with a thickness of 11.3m to 14.05m. The depth to the top of Glacial Till was record between 9.45m bgl and 10.7m bgl. 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; and

e. Flamborough Chalk Formation with a proven thickness between 0.5m and 1.5m for Grade Dm and a proven thickness of 5m to 7.95m for Grade Dc. Chalk is classified based on the engineering behaviour using the classification system defined in CIRIA C574 'Engineering in Chalk' (CIRIA 2002). Grade Dm chalk is defined as comminuted chalk where "*the material will behave as a cohesive fine soil*" (CIRIA, 2002). Grade Dc chalk is described as "*where clasts (intact chalk lumps) dominate*", resulting in the material behaving as "*a granular, coarse soil*" (CIRIA, 2002). The depth to the top of the Flamborough Chalk Formation was recorded 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. 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.

21.3.25 The Phase 2 report 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. No asbestos containing materials were encountered across the Site.

21.3.26 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 20 minutes. Groundwater seepages were recorded between 1.7m bgl and 4m bgl. A summary is provided in **Table 21.8.**

Table 21.8: Summary of groundwater strikes and seepages in the 2020 GI of the Pipeline area

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.
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.

Exploratory Hole	Depth	Strata
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

21.3.27 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.

21.3.28 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 it is not considered to present a significant risk. An outline of a Remediation Strategy will be prepared to define any mitigation measures for potential significant / unacceptable contamination risks at the Site as discussed in **paragraph 21.4.4**. If further asbestos or asbestos containing materials are encountered at the Site and the risk requires mitigation, an Asbestos Management Plan will be prepared as discussed in **paragraph 21.4.7**.

21.3.29 Exceedances of Drinking Water Standards (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.

21.3.30 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).

21.3.31 The results of the ground gas monitoring indicated the Site is classified as CS2 due to the concentrations of methane (7.6% and 11.4% within BH02).

21.3.32 The Waste Acceptance Criteria (WAC) results indicated that the waste would require treatment and re-testing before disposal at a hazardous landfill.

21.3.33 Running sands were encountered within Glacial Till between depths of 16m bgl and 19m bgl.

21.3.34 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%. It is recommended that 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

21.3.35 Ten samples were tested to determine the BRE Sulphate Classification (Ref 21-19). 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:

a. Design Sulphate (DS) class DS-1 and AC Class AC-1 for water soluble sulphate in Made Ground;

b. DS class DS-2 and AC Class AC-2 for total potential sulphate in Made Ground;

c. DS class DS-2 and AC Class AC-2 for water soluble sulphate in Tidal Flat Deposits;

d. DS class DS-5 and AC class AC-5 for total potential sulphate in Tidal Flat Deposits; and

e. Overall, the DS class is recommended as DS-2 and the ACEC classification is recommended as AC-2.

21.3.36 The Phase 2 report concludes that the contaminant linkages are absent in regard to human health and controlled waters receptors. The report also notes that the Made Ground and Tidal Flat Deposits are of a variable nature and are highly compressible and of low strength. Therefore, spread foundations or ground floor slabs will not be a suitable foundation option within Made Ground and Tidal Flat Deposits.

Coal Mining

21.3.37 The Coal Authority Interactive Viewer (Ref 21-11) indicates the green hydrogen production facility of the Site is not within a Coal Mining Reporting Area and is not within a Development High Risk Area. The Humber Estuary, including the proposed jetty area, is designated as a Coal Mining Reporting Area. The proposed development lies within a coal mining area which may contain unrecorded coal mining related hazards. If any coal mining feature is encountered during development, this should be reported immediately to the Coal Authority on 0345 762 6848.

Hydrogeology

21.3.38 A summary of the hydrogeological conditions for the Site are provided in **Table 21.9**.

Table 21.9: Aquifer Designations

Strata	Designation	Definition (Ref 21-20)
Beach and Tidal Flat Deposits	Secondary (Undifferentiated)	The EA describe Secondary (Undifferentiated Aquifers) as *"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".*
Tidal Flat Deposits	Unproductive Aquifer	The EA describe Unproductive Aquifers as "*largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them".*
Flamborough Chalk Formation	Principal	The EA describe Principal Aquifers as aquifers that *"provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands".*

21.3.39 The Groundsure Report (GS-9009838) (Ref 21-15) 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'.

21.3.40 There are no Drinking Water Protected Areas (Surface Water) or Drinking Water Safeguard Zones (Groundwater) within the Site.

21.3.41 The groundwater vulnerability map on Defra's MAGIC Maps (Ref 21-12) and in the Groundsure Report (GS-9009838) (Ref 21-15) indicates that the West Site, and most of the Pipeline and East Site have a *Low* groundwater vulnerability. The EA (Ref 21-21) describe a *Low* groundwater vulnerability is described 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.

21.3.42 The northeast Temporary Construction Area, and the northeast area of the East Site and Pipeline area are designated as a *Medium – High* groundwater vulnerability on Defra's MAGIC Maps (Ref 21-12) and as a *High* vulnerability in the Groundsure Report (GS-9009838) (Ref 21-15). The EA (Ref 21-21) describes a *Medium* groundwater vulnerability as "*areas that offer some groundwater protection. Intermediate between high and low vulnerability*" and a *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 northeast Temporary Construction Area which are underlain by Tidal Flat Deposits and in turn Devensian Till deposits.

21.3.43 SPZs are located on the entire Site, as shown in Figure 21.6 (PEI Report Volume III). An SPZ 1 (Inner Catchment) is located in the southern half of the Site within the proposed pipeline route and West Site, near Queens Road. The EA (Ref 21-22) describe an SPZ 1 as a "*50 day travel time of pollutant to source with a 50 metres 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, and further north within the proposed pipeline route. The EA (Ref 21-22) describe an SPZ 2 as a "*400 day travel time of pollutant to source. This has a 250 or 500 metres 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 proposed pipeline route, East Site and northeast Temporary Construction Area. The EA (Ref 21-22) 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 due to the designation as a Principal Aquifer, although this information has not been confirmed. The Chalk is overlain and confined by a considerable thickness of superficial strata which are themselves not productive aquifers.

21.3.44 An SPZ 2c (Outer Catchment within a Confined Aquifer) is also located on the Site, within the northern corner of the West Site. It is noted in the Groundsure Report (GS-9009838) (Ref 21-15) 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.

21.3.45 There are no groundwater abstractions located within the Site boundary. The closest groundwater abstraction is located as 27m northwest from the West Site associated with an historical raw water supply abstraction. An active groundwater abstraction is located approximately 37m northwest from the West Site, associated with raw water supply. These groundwater abstractions are associated with the SPZ 1 within the Site boundary.

21.3.46 In the wider area, there are a further eight groundwater abstractions within 1km of the Site. Of the nine groundwater abstractions, three are considered to be active and six are considered to be historical abstractions.

Surface Waters

21.3.47 The EA Catchment Data Explorer (Ref 21-13) and the Groundsure Report (GS-9009838) (Ref 21-15) indicates the entire Site is located within the catchment for the North Beck Drain water body. The ecological classification (dated to 2019) is defined as 'moderate'. The 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 proposed pipeline route. The Habrough Marsh Drain is part of the North Beck Drain catchment and is located to the west of the Site.

21.3.48 The marine side of the Site is also 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, Perfluoro octane 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.

21.3.49 There are approximately forty-four 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 is not clear. However, it indicates that water lines are located within all sub sites. There are a further twenty-eight OS Water Network Lines within 50m of the Site boundary, and forty-nine between 250m and 500m from the Site boundary.

21.3.50 There are no licensed surface water abstractions within the Site boundary or within 1km from the Site.

Historical Development

21.3.51 A summary of the historical development within the Site boundary and within the 500m study area is provided in **Table 21.10**.

Table 21.10: Summary of historical development within the Site and the study area

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
1886 – 1888 (1:2,500 and 1:10,560)	• Agricultural fields in all areas of the Site. • 'North Beck Drain' is denoted within the northeast Temporary Construction Area. • A surface water feature and a forested area identified as 'Long Strip' (a forested area) are shown in the Pipeline area. • 'Beacons' are denoted in the Pipeline area.	• Agricultural fields in all areas of the Site. • 'North Beck Drain' is denoted approximately 345m southeast from the West Site area. • 'Springs' are denoted at 'Habrough Marsh' approximately 185m west from the Pipeline route, approximately 360m south and 400m southeast from the West Site. • A water feature flowing northeast is shown immediately west from the Pipeline area and East Site. • A 'Sluice' is denoted approximately 225m north from the East Site. • A 'Pump' is shown approximately 105m east from the northeast Temporary

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
		Construction Area, 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)	• Two 'Springs' are shown in West Site area and two 'Springs' are shown within the Pipeline area.	• Multiple 'Springs' are denoted within a 1km radius from the Site. • A 'Well' is denoted at 'Habrough Marsh' west of the Pipeline route. • The pumps at the 'Ship Inn' and 'Coastguard Station' to the east of the northeast Temporary Construction Area are no longer shown.
1907 (1:2,500)	• Water features, assumed to be drains, are shown through the Pipeline area.	• A small pond or lake is denoted within the centre of the Pipeline area.
1910 (1:10,560)	• No significant changes.	• Further 'Springs' are denoted within 1km west from the Site.
1930 - 1931 (1:10,560)	• Residential housing is shown adjacent to 'Queens Road' in the West Site. • 'L.N.E.R. Grimsby District Electric Light Railway' is shown through the centre of the Pipeline route Site (area of the proposed pipeline route) 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 area.	• Railway sidings are denoted approximately 80m north from the West Site. • A 'Signal Box', 'Engine Shed' and 'Store' are shown between approximately 130m and 560m northwest from the West Site. • A 'Sewage Works' is denoted approximately 60m east from the Pipeline area. • An 'Allotment Garden' is shown adjacent to the northern boundary of the West Site. • A 'Methodist Church' and a 'Club' are denoted approximately 500m west from the West Site. • The 'Ship Inn', 'Stallingborough Light' and the 'Coastguard Station' are no longer denoted near the northeast Temporary Construction Area, however, the buildings are still shown.
1932 (1:2,500)	• The 'North Beck Drain' is diverted outside of the northeast Temporary Construction Area Site boundary.	• A 'Well' is shown near the buildings formerly identified as a 'Coastguard Station' near the northeast Temporary Construction Area.

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
	• A small building is shown near the southern boundary of the Pipeline area.	
1938 (1:10,560)	• No significant changes.	• No significant changes.
1946 – 1947 (1:10,560)	• A further small building is denoted near the southern boundary of the Pipeline area.	• No significant changes.
1947 – 1948 (1:10,560)	• No significant changes.	• No significant changes.
1947 – 1951 (1:10,560)	• No significant changes.	• Buildings are denoted approximately 500m west from the Pipeline area near the railway sidings.
1951 – 1956 (1:10,560)	• A 'Gypsum Disposal Bed' is denoted partially on the West Site boundary and extends further southeast off-Site. • The 'L.N.E.R. Grimsby District Electric Light Railway' is no longer shown in the Pipeline area.	• Buildings and railway lines associated with a 'Chemical Factory' are denoted approximately 350m southeast from the northeast Temporary Construction Area.
1964 (1:2,500)	• 'Drains' are denoted in the West Site and the Pipeline area. • Further small buildings are denoted on the Site boundary of the West Site. • Electricity lines are denoted through the East Site.	• Buildings are denoted 30m west from the West Site. • 'Water' is denoted immediately south from the West Site. • 'Pipelines' are denoted immediately adjacent to the west of the Pipeline area 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. • Several circular structures are denoted approximately 500m west from the East Site. • A 'Works'and 'Tanks' are shown adjacent to the 'Sewage Works' near the Pipeline area. • An 'Electric Sub Station' is shown approximately 10m southeast from the Pipeline area.

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
		• A 'Jetty' is denoted adjacent to the 'Sluice' on the Humber Estuary approximately 235m north from the East Site area. • 'Drains' are denoted to the east of the northeast Temporary Construction Area. • A 'Pond' is denoted approximately 80m east from the northeast corner of the Site. • 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 northeast Temporary Construction Area. • A 'Jetty' is denoted near the 'Works' approximately 428m east from the northeast Temporary Construction Area.
1965 – 1968 (1:2,500 and 1:10,560)	• The 'Spring' in the west of the Site is no longer shown and further 'Drains' are denoted.	• Several buildings are denoted adjacent to the West Site boundary near 'Kings Road'. • 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. • Buildings associated with 'Works' are denoted approximately 500m west from the Pipeline area. • The 'Gypsum Disposal Beds' to the east of the West Site are no longer shown.
1969 – 1972 (1:2,500)	• Electricity pylons are denoted through the West Site and extends further offsite. • 'Pipelines' are shown on the northwest Site boundary in the Pipeline area of the Site which extend off-site.	• An 'Electric Sub Station' is denoted approximately 40m west from the East Site. • An 'Oil Storage Depot' is denoted approximately 200m west from the East Site. • Multiple 'Tanks' are denoted within 500m west from the East Site associated with the 'Oil Storage Depot', an unspecified 'Works' and a 'Chemical Works'. • 'Electric Sub Stations' are denoted adjacent to the Site boundary and

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
		approximately 15m west from the West Site. • A 'Transforming Station' and a 'Pump House' are shown approximately 25m west and 200m west from the Site (West Site area) respectively. • The 'Engine Shed' associated with the railway sidings located to the north of the West Site area 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 near the railway sidings. • A 'Warehouse' and 'Chemical Works' are denoted approximately 85m and 80m east from the East Site respectively on 'Laporte Road'. • An 'Oil Storage Depot' with multiple 'Tanks' is denoted approximately 35m north from the East Site, near to the Humber Estuary. • 'Pipelines' and 'Jetty (Oil Terminal)' are denoted approximately 365m northwest from the East Site into the Humber Estuary. • Another 'Chemical Works' with multiple 'Tanks' is denoted approximately 100m east from the northeast corner of the Site.
1972 – 1976 (1:10,000)	• No significant changes.	• No significant changes.
1976 – 1979 (1:2,500)	• No significant changes.	• 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 area. • The 'Works' near the 'Sewage Works' to the east of the Pipeline area are no longer denoted.

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
		• A building associated with 'GVC' is shown approximately 270m east from the northeast Temporary Construction Area. • Further buildings and structures are shown associated with the 'Chemical Works' to the east of the northeast Temporary Construction Area.
1980 – 1985 (1:2,500 and 1:10,000)	• No significant changes.	• A 'GVC' and 'Pumping Station' are located adjacent to the Site boundary in the West Site area. • A 'Pipeline' is shown approximately 70m north from the West Site area. • Another 'GVC' is denoted approximately 230m southeast from the northeast Temporary Construction Area.
1985 – 1987 (1:2,500)	• The 'Springs' in the Pipeline area are no longer shown	• The 'Transforming Station' to the west of the West Site 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 is no longer shown. • The circular structures at the 'Sewage Works' to the east of the Pipeline area are identified as 'Filter Beds'. • A 'Warehouse' is denoted approximately 500m southeast from the West Site. • A 'Pipeline' is denoted approximately 410m southeast from the Pipeline area and East Site, near the 'GVC' and 'North Beck Drain'.
1988 (1:10,000)	• No significant changes.	• The railway lines associated with the 'Works' adjacent to the northeast Temporary Construction Area are now identified as a 'Dismantled Railway'.
2001 (1:10,000)	• No significant changes.	• 'Works' are denoted approximately 50m northwest from the West Site area. • Small ponds are denoted within the 'Oil Storage Depot' to the west of the East Site. • The 'GVC' and 'pipeline' to the southeast of the northeast Temporary Construction Area are no longer denoted.

Date and Scale	Significant Features Onsite	Significant Features Off-Site (within 500m radius)
		• Further 'Works' are denoted adjacent to the eastern Site boundary in the northeast Temporary Construction Area.
2010 (1:10,000)	• No significant changes.	• A 'Recycling Centre' is denoted adjacent to the West Site boundary. • A pond is shown approximately 50m southeast from the West Site.
2022 (1:10,000)	• No significant changes.	• The 'Recycling Centre' located to the West Site is no longer shown. • Further ponds are shown to the southeast of the West Site. • 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

21.3.52 The following regulated processes and pollution incidents are recorded on the Site and within 500m from 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 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 that is operated by Associated Petroleum Terminals and 365m northwest that is 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. Integrated Pollution Control permits were held by Cray Valley Ltd for manufacture and use of organic chemicals. Permits are held by the following operators approximately 396m 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 76m south; UK Power Reserve Limited approximately 80m southwest; Immingham Power Limited approximately 81m southeast; Associated Petroleum Terminals Ltd approximately 108m north; Associated Petroleum Terminals Ltd approximately 144m northeast; Knauf UK approximately 306m northwest and 366m northwest; North Beck Energy Limited approximately 321m east; Integrated Waste Management approximately 323m southeast; PX Ltd and Npower Cogen Ltd approximately 346m southeast and 377m southeast; and Millennium Inorganic Chemicals, Tronox Pigment UK Ltd and Cristal Pigment UK Ltd approximately 486m southeast.

h. Hargreaves Industrial Services Ltd hold a permit for licenced pollutant release for coal and coke processes within the Site boundary. PD Ports hold a permit for coal and coke processes approximately 81m southwest from the Site. WTG Treatment Ltd hold a permit for timber manufacturing approximately 126m northwest and Knauf UK (Gypsum) hold a permit for other mineral processes approximately 180m northwest from the Site.

i. There are no records for radioactive substance authorisations within the Site boundary. Millennium Inorganic Chemicals Ltd held a permit for radioactive substance authorisations for the disposal pf radioactive waste approximately 477m south. The status is recorded as revoked / cancelled.

j. 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. A permit for a licenced discharge into controlled waters is held approximately 1m southwest of the Site for miscellaneous discharges (surface waters) into Stallingborough North Beck. Another permit is held for sewage discharges into an unnamed tributary of the North Beck Drain within approximately 44m southeast of the Site boundary. Two permits for licenced discharge into controlled waters was held on the Site boundary for sewage discharges into an unknown tributary of the North Beck Drain, although this was revoked in May 1995 and December 2000. Further permits are held between 58m

northwest and 261m 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.

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. There are three effective permissions for pollutant release to public sewer located within the Site boundary. These are associated with Integrated Waste Management Ltd and Inspectorate International Limited.

o. List 1 Dangerous Substance 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 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.

p. List 2 Dangerous Substance 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.

q. A pollution incident was recorded on 21st 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).

r. A pollution incident occurred on 20th 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 27th 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 25th July 2002 approximately 339n southeast associated with specific waste materials. The water, land and air impact were recorded as Category 4 (No Impact).

s. Pollution inventor 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).

t. 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

21.3.53 The boundary of an active landfill is partially located on the eastern side of the Site boundary, within the West Site area. 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.

21.3.54 The border of an historical gypsum disposal bed waste site encroaches on the south-eastern side of the Site boundary, within the West Site and Pipeline areas of the site. A further historical waste site (landfill works) is located within the Site boundary in the West Site, although this relates to a planning application. A planning application for a waste transfer station is located 458m east from the Site.

21.3.55 Two historical landfill sites are recorded on the south-eastern boundary of the West Site and Pipeline areas 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 31st December 1990.

21.3.56 There are five licenced waste sites located on the site, between approximately 41m and 304m from the Site:

a. Immingham Household Waste Recycling Centre is located within the Pipeline area, 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 status is recorded as ‘To PPC’.

c. Sandstop Recycling is located approximately 98m northwest from the Pipeline area 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 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 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 status of the site is recorded as 'IPPC'.

21.3.57 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.

21.3.58 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.

Potential Historical Sources of Contamination

21.3.59 The potential sources of contamination include the following:

a. Made Ground, natural strata, soil leachate, groundwater and ground gas;
b. Historical railways and sidings within the Site boundary;
c. The historic gypsum disposal bed encroaching on the West Site boundary and off-site towards the east of the Site;
d. Pipelines located within the Site boundary;
e. Potential agricultural land use within the Site boundary;
f. Industrial land use within the Site boundary including energy production, vehicle services, industrial engineers, tool shops, recycling and disposal, industrial products and a gas governor;
g. An active landfill partially encroaching on the West Site boundary; and
h. Off-site sources including current and historical landfills within a 1km radius, industrial land use in the surrounding study area (current / former railway sidings and associated infrastructure, a sewage works, jetties, oil storage depots, chemical works, unspecified works, pipelines and warehouses).

Potential Pathways

21.3.60 The following pathways have been identified:

a. Dermal contact, direct contact, ingestion, inhalation and plant uptake for soil sources;
b. Vertical and lateral migration of contaminants via groundwater and surface run-off; and
c. Migration of ground gas.

Potential Receptors

21.3.61 Potential receptors include the following:

a. Human health.
b. Geology (Made Ground, superficial deposits and bedrock).
c. Hydrogeology (Unproductive, Secondary Undifferentiated and Principal Aquifers and groundwater).

d. Soils.

e. Development Infrastructure.

Environmental Risk Assessment

21.3.62 An Environmental Risk Assessment was undertaken as part of the Phase 1 Desk Study for the Site which has been used to determine the potential pollutant linkages and potential effects to ground conditions and land quality in this PEI Report. The Phase 1 Desk Study identified that the risk to receptors ranged between *Very Low* and *Moderate* for the Site, which is considered to be *Acceptable* using the LC:RM risk ratings. The following pollutant linkages were identified:

a. The risk to future site users is considered *Low* for all contaminant linkages;

b. The risk to adjacent site users is considered *Low* for all contaminant linkages;

c. The risk to buildings and infrastructure is considered *Moderate/ Low* to *Moderate* for all contaminant linkages;

d. The risk to shallow groundwater (within Secondary Undifferentiated Aquifer) is considered *Moderate / Low* for all contaminant linkages;

e. The risk to deep groundwater (Principal Aquifer of the Flamborough Chalk Formation) is considered *Moderate / Low* for all contaminant linkages;

f. The risk to surface water is considered *Moderate* for all contaminant linkages; and

g. The risk to flora and fauna is considered *Very Low* to *Low*.

Geotechnical Risks

21.3.63 A Geotechnical Risk Assessment and Initial Ground Hazards Assessment were undertaken as part the Development Appraisal Report (Ref 21-16). The Geotechnical Risk Assessment and Initial Ground Hazards Assessment noted the following:

a. There is a substantial risk, after control measures are applied, associated with instability in open excavations and shallow groundwater flooding excavations;

b. There is a tolerable risk, after control measures are applied, associated with the following:

   i. Aggressive ground conditions;

   ii. Existing services (underground and overhead);

   iii. Variable Made Ground; presence of soft / compressible strata at shallow and deep depths;

   iv. Hard digging associated with boulders in Glacial Till and obstructions in Made Ground; and

   v. The weathered zone in Chalk bedrock which may be unsuitable for foundations.

c. There is a trivial risk, after control measures are applied, associated with frost susceptible soils and impermeable stratum;

21.3.64 The Initial Ground Hazards Assessment identified the following:

a. There is a medium severity associated with aggressive ground. It is recommended that BRE test results should be used to determine the appropriate concrete mix;

b. There is a high severity associated with Made Ground. It is recommended that a GI is undertaken to determine the potential thickness and composition of Made Ground. It is noted that Made Ground will be unsuitable for shallow and deep foundations. Potential foundation solutions include excavation of Made Ground and replacement with engineered fill; use of vibro stone columns or deep piled foundations. The engineered fill solution may not be economical;

c. There is a high severity associated with soft and compressible strata, therefore it is recommended that a GI is undertaken at the Site. It is noted that the superficial deposits may be unsuitable for shallow and deep foundations. Potential solutions proposed include vibro stone columns; rigid inclusions founded in Glacial Till; settlement reducing piles founded in Glacial Till and deep piled foundations into competent material. The report also proposes to excavate Made Ground and replace with engineered fill, however, this may not be economical. Soil mixing via lime stabilisation may allow the construction of shallow foundations;

d. There is a medium severity associated with hard dig and potential for surface and buried obstructions. The proposed solution an allowance for hard dig to be included within the project programme and cost, as well as consideration with deep foundation design;

e. There is a medium severity associated with weathered bedrock. A GI is recommended to determine the potential thickness and composition of weathered bedrock. The weathered zone may be unsuitable for heavily loaded structures; therefore, it is recommended to use deep piled foundations into competent fresh material;

f. There is a very high severity associated with shallow groundwater. It is recommended that the project programme and cost should account for shallow groundwater conditions; and

g. There is a medium severity associated with soil and groundwater contamination, therefore, it is recommended that a GI is undertaken at the Site.

Future Baseline

21.3.65 As stated in the Scoping Report, the future baseline conditions for ground conditions and land quality are anticipated to remain unchanged from those as described above in the absence of the Project.

21.4 Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

21.4.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to population and health through the process of design development, and by embedding mitigation measures into the design. A summary of the proposed embedded mitigation measures is provided as follows and in **Section 21.6**.

Mitigation Measures

21.4.2 A summary of the primary, secondary and or tertiary mitigation measures in relation to the geological and hydrogeological environment for the construction phase and operational phase is provided in the following paragraphs and summarised in **Section 21.6**.

Construction Phase Mitigation Measures

21.4.3 A GI will be undertaken at the Site to obtain geo-environmental and geotechnical site specific data which will be used for the following: an assessment of ground conditions at the Site; derivation of geotechnical parameters and use of data for land contamination risk assessments. The data from GI will also be used within the detailed design process. As part of the secondary mitigation measures for the Project, a CEMP would be prepared to mitigate the potential impacts (magnitude and significance (effect)) during construction. An outline CEMP will be prepared as part of the DCO application for the Project and will detail measures to limit the dispersal and accidental release of soil derived dusts, uncontrolled run-off and accidental releases of potential contaminants. The development will not commence until a detailed CEMP has been approved in writing by the Planning Authority and secured by requirement of the DCO.

21.4.4 An outline of a Remediation Strategy will be prepared to support the DCO application. It is anticipated that a final Remediation Strategy will be prepared as part of the CEMP. The Remediation Strategy will define the mitigation measures required for significant / unacceptable contamination risks and it will outline how the green hydrogen production facility earthworks will be undertaken during construction. The necessary works required in preparation of the Project, including Site clearance, will also be outlined in the strategy. As part of the Remediation Strategy, the potential for reuse of surplus materials will be considered, and the potential for disposal or onward management to ensure appropriate re-use of materials. If surplus materials can be reused on Site, the strategy will define any treatment measures required and will define a risk-based compliance criteria for soils to be screened against prior to potential reuse on Site. If soil materials are considered to be surplus, the soil materials will be classified under the *Waste Framework Directive (Waste FD) (2009/98/EC)* 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.

21.4.5 To ensure suitable re-use of materials such as crushed concrete and soils, a Materials Management Plan (MMP) under CL:AIRE (2011) Definition of Waste: Development Industry Code of Practice, will be prepared and implemented for the Project to detail measures to classify, track, store, dispose and potentially re-use excavated materials encountered.

21.4.6 Following the GI and geotechnical assessments, the construction methodology of the Project will be assessed to reduce 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, such as through piled foundations. 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 and 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 21-29) and “Piling in Layered Ground: risks to groundwater and archaeology – Since Report SC0200074/SR” (Ref 21-30). Piling method statements should detail measures to protect the aquifer if there is potential to cause pollution.

21.4.7 If asbestos or asbestos containing materials are encountered in the GI, and the presence is confirmed and quantified in chemical screening and a risk assessment identifies a risk requiring mitigation, an Asbestos Management Plan (AMP) will be prepared and implemented. The outline AMP will be prepared as part of the ES and CEMP.

21.4.8 The proposed GI will aim to identify the potential suitability of excavated materials for re-use. Earthworks operations on the Site should be undertaken in accordance with BS1997:2004 Eurocode 7 (Ref 21-31), BS16907-1 to 7:2018 Earthworks (Ref 21-32); BS6031:2009 Code of Practice for earthworks (Ref 21-33) and National Highways (NH) guidelines including DMRB Series 600 ‘Earthworks’ (Ref 21-34).

21.4.9 It is anticipated that best practice guidance and mitigation measures outlined in the CEMP will be adhered to, to prevent or minimise spillage risks and impacts during the construction phase. The CEMP will also address accidental spillages associated with building construction, foundations, concrete usage and the management of concrete batching.

21.4.10 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. Furthermore, if such material stockpiles are not used within three months, temporary covers or reseeding measures, for soils, should be implemented. When the Project is reinstated, reseeding or covering of unused and exposed soils will be undertaken, and erosion protection matting may also be used. These mitigation measures will minimise the potential for sediment mobilisation via wind and water flows.

21.4.11 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 would be agreed with the local planning

authority and / or the EA and defined in the CEMP. **Chapter 17: Marine Water and Sediment Quality** and **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage** discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses, such as through the use of an oil spill contingency plan and spill kits on site.

21.4.12 Construction workers on the Site will adhere to site specific health and safety assessments, legislation and regulations. Site-specific risk assessments and the use of personal protective equipment should be a pre-requisite for workers coming onto Site. Entry into excavations or any other enclosed space on a construction site should comply with confined space legislation and be assessed prior to entry. To minimise the risk to off-site human health, general best practice guidance should be followed on Site to minimise dust generation, as outlined in, for example, “Environmental Good Practice on Site”, 3rd Edition, CIRIA Publication C762 (Ref 21-35).

21.4.13 An Agricultural Land Classification Survey will be undertaken prior to the submission of the ES to confirm the subgrades of ALC Grade 3 land within the Site boundary.

21.4.14 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.

Operational Phase Mitigation Measures

21.4.15 For tertiary mitigation, the Project will operate in accordance with and comply with relevant legislation and regulations and the hydrogen production facility will be regulated by the Environment Agency through an Environmental Permit.

21.4.16 Potential impacts may arise during the operational phase related to potential accidental spillage of polluting materials. Embedded mitigation, which will include the use of impermeable surfacing and bunding, as well as secondary mitigation of process monitoring and an Environmental Management System, will minimise the potential risk associated with potential accidental spillages. **Chapter 17: Marine Water and Sediment Quality** and **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage** discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses.

21.4.17 It is anticipated that workers would 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 would be provided for such assessments to be undertaken. Workers will be required to use personal protective equipment prior to coming onto Site. Appropriate emergency environmental management plans and procedures, in accordance with legislation, regulations and industry best practice, will be in place for the

operational stage. It is also anticipated that the storage of hazardous substances on the Site would be approved by the LA and regulated by the Competent Authority through a Hazardous Substance Consent and COMAH.

Decommissioning Phase Mitigation Measures

21.4.18 The Project will have a design life of 25 years and could operate longer depending on market conditions. The green hydrogen production facility infrastructure will be decommissioned at an appropriate time after the operational phase. Above ground structures will be removed and suitably reused or recycled where possible or disposed. The process structures are generally modular to ease construction and de-construction underground pipelines are proposed to be left in situ and will be made safe. It is proposed that the land will be restored to a satisfactory state following the decommissioning and removal of above ground structures.

21.4.19 An outline Decommissioning Environmental Management Plan (DEMP) will be produced as part of the DCO application to minimise or avoid potential impacts associated with the decommissioning of green hydrogen production facility. A detailed Decommissioning Plan will be secured by requirement of the DCO.

21.4.20 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.

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.

21.5 Potential Impacts and Effects

21.5.1 This section discusses the potential ground conditions and land quality impacts and effects that may arise during the construction, operation and decommissioning of the green hydrogen production facility.

21.5.2 The DCO application would not make any provision for the decommissioning of the marine infrastructure or plant or equipment on the jetty topside. This is because the development would, once constructed, become part of the fabric of the Immingham port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. This is discussed further in **Chapter 2: The Project**.

21.5.3 A GI will be undertaken at the site to inform further assessments and engineering design based on encountered ground conditions. The results of the GI will be presented in the ES. The UK Specification for GI will be used to specify the GI, and it should be carried out in accordance with BS EN 1997-2:2007 Eurocode 7 (Ref 21-23), BS5930:2015+A1:2020 Code of practice for GIs (Ref 21-24) and BS10175:2011+A2:2017 Investigation of potentially contaminated sites Code of Practice (Ref 21-25).

21.5.4 Further assessment of contamination at the Site will be undertaken as part of the ES, including potential contamination sources, receptors and plausible pollutant linkages. This assessment will be undertaken in accordance with government

guidance and the UK framework for risk assessments for contaminated land, including the Land Contamination: Risk Assessment guidance (Ref 21-26) from the EA. The EA guidance for land contamination in assessing risks to controlled waters (Ref 21-27) and the principles of assessment in CIRIA C552 (Ref 21-28) will be taken account. Previous GI's have been undertaken in the Pipeline area and the West Site; therefore, additional areas of the site are being investigated as part of a GI to obtain a complete understanding of the ground conditions within the boundary of the entire Site. The data from previous GI's and the data obtained in the additional GI will be used to inform the assessment within the ES.

21.5.5 **Chapter 25: Cumulative and In-Combination Effects** of this PEI Report will consider the in-combination effects on geology, controlled waters and human health which could arise from the Project. This will be considered as part of the Cumulative and In-Combination Assessment.

21.5.6 The potential impacts associated with the construction, operational and decommissioning phases for ground conditions and land quality are associated with:

a. Direct contact with contamination;

b. Inhalation of dust and / or soil derived vapours;

c. Migration of ground gas; and

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

21.5.7 The assessment considers the receptors noted in **Paragraph 21.3.61**. A summary of the value (sensitivity) of the receptors is presented in **Table 21.11**.

Table 21.11 Value (sensitivity) of receptors

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
Human Health				
Human Health	Workers and site visitors	Onsite	Medium	Workers and site visitors on Site are considered to be a 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	Offsite	Medium	The workers and site visitors located offsite are considered to be a Medium sensitivity due to the commercial / industrial land use within the wider area, including the Port of Immingham. The offsite workers and site visitors 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. The Burnham Chalk Formation underlies the western site boundary and the Flamborough Chalk Formation.	Negligible	There are no geological exposures, and little / no local interest. The bedrock is overlain by thick superficial deposits.
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.

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
Geology Superficial	Beach and Tidal Flat Deposits (Undifferentiated)	Northeastern boundary of the green hydrogen production facility 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.	High	The West Site and the eastern half of the Temporary Construction Area are designated as ALC Grade 3.
Hydrogeology and Hydrology				
Groundwater (Bedrock)	Principal Aquifer (Flamborough Chalk Formation)	The entire Site.	High	The Flamborough Chalk Formation 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	Northeastern boundary of the green hydrogen production facility 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.

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
	Deposits (Undifferentiated)			
	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.
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.
Development Infrastructure				
Development Infrastructure – Buildings and Services	Buildings	On Site in the future	High	There is potential for aggressive ground conditions and accumulation of ground gases at the Site which may degrade the foundations if the design does not account for the ground conditions.
Development Infrastructure – Buildings and Services	Services	On Site in the future	Medium	There is potential for aggressive ground conditions and accumulation of ground gases at the Site which may degrade the services if the design does not account for the ground conditions.
Ecological Systems				

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
Ecological Systems	Humber Estuary	The Humber Estuary is located within the Site boundary to the northeast of the Site.	Very High	The Humber Estuary is designated as an SSSI, SPA, SAC and a Ramsar site.

Construction

21.5.8 This section contains an assessment of the potential impacts of the construction phase on the Project. There is potential for sediment bound contaminants of concern to be mobilised as a result of dredging operations for the marine development. The potential impacts are discussed further in **Chapter 17: Marine Water and Sediment Quality** and **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage**

21.5.9 The following impact pathways have been assessed prior to the implementation of mitigation measures:

a. Direct contact with contamination;

b. Inhalation of dust and / or soil derived vapours;

c. Migration of ground gas; and

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

21.5.10 There may be potential impacts to human health (on site workers and future site visitors), geology and soils, groundwater and surface water at the Site.

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

21.5.11 Through the application of primary and tertiary mitigation, human health receptors include on site workers and future site visitors are not likely to be affected during the construction stage.

21.5.12 Without appropriate controls, 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. However, a GI will be undertaken across the Site to obtain site specific geo-environmental data for land contamination risk assessments that will assess the potential impact to human health. Workers on the Site will comply with the relevant health and safety legislation, site specific risk assessments and will also use PPE on the Site. The construction phase may also result in potential temporary impacts to human health arising from accidental spillages and leakages from vehicular plant and stored liquids, as well as the use of substances or materials that have the potential to become a pollutant (concrete, fuel, oils and soil). Such spillages, leakages and substance / material use may be mobilised to the ground or controlled waters. However, the Site will be operated in accordance with the relevant legislation, regulations, licence/permit, the Construction Environmental Management Plan (CEMP) and standard industry practices to mitigate the potential impacts.

21.5.13 Without implementation of the appropriate mitigation measures and controls, the construction phase may result in adverse impacts on the geology and soils 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 boundary and will hence require off-site disposal. However, it is anticipated that the Site will be operated in accordance with the CEMP, relevant legislation, regulations, permits / licences and standard industry practices that will minimise the potential for adverse impacts to geology and soils. There is potential for beneficial impacts during the construction stage if any contaminated soil that is encountered is treated or removed, therefore removing the potential for adverse effects on the receptor. Drainage on the Site may also reduce the potential for soil erosion.

Migration and accumulation of ground gas

21.5.14 There is potential for ground gas to accumulate within temporary structures erected on Site during the construction phase. BGS mapping indicates Made Ground is present within the Site boundary, and warp was encountered within BGS borehole records which may be a source of ground gas. The underlying organic rich soils and Flamborough Chalk Formation may be a further source of ground gas as well as the landfills located in the vicinity of the Site within the study area. Furthermore, the GI undertaken by RSK (Ref 21-19) of the southern half of the East Site recorded elevated methane concentrations. However, a GI will be undertaken across the Site to obtain site specific data, including for gassing potential, which will be used in risk assessments to implement appropriate remediation and / or ventilation measures. Entry into any enclosed spaced or excavation on a construction site should comply with confined space legislation and be assessed prior to entry.

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

21.5.15 Without implementation of appropriate mitigation measures, the construction phase may result in potential contamination to controlled waters (Secondary Undifferentiated Aquifer, Unproductive Aquifer, Principal Aquifer, Humber Estuary, North Beck Drain and Habrough Marsh Drain).

21.5.16 There is potential for disruption to shallow groundwater as a result of excavations and foundations if mitigation measures are not implemented. 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. Therefore, there is potential for an adverse risk to groundwater if mitigation measures are not implemented. 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. However, it is anticipated that a hydrogeological assessment will be undertaken that will consider potential impacts to nearby abstractions and resources. A dewatering scheme will also be implemented that will minimise the impact associated groundwater controls during the construction phase.

21.5.17 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 if appropriate mitigation measures are not implemented. However, a development specific CEMP will mitigate the potential risks and it is anticipated that the Site will operate in compliance with the relevant environmental permit requirements.

21.5.18 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. 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) and bedrock aquifers (Principal Aquifer of the Flamborough Chalk Formation) on the Site if appropriate mitigation measures are not applied. However, if piled foundations are required, a piling risk assessment will be undertaken and piling method statements should detail the measures to protect the aquifer if there is potential to cause pollution. The GI will obtain site specific data on the geo-environmental conditions at the Site, and will inform land contamination risk assessments that will consider the risk to the aquifers present on Site.

21.5.19 There is potential for the removal, relocation or mobilisation of potential contaminants as a result of the disturbance and / or removal of ground material and groundwater during foundation construction, earthworks and excavations if mitigation measures are not implemented. However, the Site will be operated in accordance with the CEMP during the construction phase which will mitigate potential impacts associated with the disturbance and removal of ground material and groundwater.

21.5.20 Without appropriate mitigation measures, potential contaminant linkages or mobilisation of existing contaminants may arise from the exposure of soils / increases in rainwater infiltration through changes in ground cover / in bulk earthworks and excavations. However, the Site will be operated in accordance with the CEMP during the construction phase which will mitigate potential impacts associated with potential contaminant mobilisation during the construction phase.

Operation

21.5.21 This section contains an assessment of the potential impacts of the operational phase on the Project.

21.5.22 The following impact pathways have been assessed prior to the implementation of mitigation measures:

a. Direct contact with contamination;

b. Inhalation of dust and / or soil derived vapours;

c. Migration of ground gas; and

d. 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

21.5.23 Although future on site workers and site visitors are anticipated to spend longer durations of time on the Site, 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 the site will be regulated by the EA through the Environmental Permit. The Site will also be regulated by the Health and Safety Executive through the implantation of Hazardous Substance COMAH licence. The human health receptors may change from the baseline conditions as additional human health receptors may include site workers, commercial users and visitors.

21.5.24 The geology and soils beneath the Site are unlikely to be receptors during the operational stage as the Site will be covered in hardstanding which will remove the pathway in the pollutant linkage.

Migration and accumulation of ground gas

21.5.25 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, a GI will be undertaken at the Site prior to the ES, and the gassing potential of the Site will be determined. The results of the gassing potential will be interpreted and used in risk assessments to inform and implement appropriate remediation and / or ventilation measures. The design and build of structures will incorporate ground gas protection measures as necessary. An Operational Environmental Management Plan will also mitigate the potential risk associated with the migration and accumulation of ground gas.

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

21.5.26 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 the Environmental Permit, relevant legislation, regulations, licence/permit and standard industry practices to mitigate the potential impacts. The site will also be regulated by the Health and Safety Executive through the implantation of Hazardous Substance Consents and the COMAH licence which will further mitigate the potential impacts.

Decommissioning

21.5.27 This section contains an assessment of the potential impacts of the decommissioning phase of the green hydrogen production facility on the Project.

21.5.28 The following impact pathways have been assessed prior to the implementation of mitigation measures:

a. Direct contact with contamination;

b. Inhalation of dust and / or soil derived vapours; and

c. 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

21.5.29 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 if appropriate mitigation measures are not applied. However, the Site will be operated in accordance with a DEMP, relevant legislation, regulations, licence/permit and standard industry practices to mitigate the potential impacts. Workers on site will adhere to site specific risk assessments and the requirement to use personal protective equipment on the Site. Entry into excavations or any other enclosed space on a construction site should comply with confined space legislation and be assessed prior to entry.

21.5.30 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 appropriate mitigation measures are not applied. 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 to be 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 the DEMP, relevant legislation, regulations, licence/permit and standard industry practices to mitigate the potential impacts.

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

21.5.31 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. This may migrate via surface run-off and lateral and vertical migration to surface water receptors and groundwater receptors respectively if appropriate mitigation measures are not applied. However, the Site will be operated in accordance with the DEMP, relevant legislation, regulations, licence/permit and standard industry practices to mitigate the potential impacts.

21.5.32 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 if appropriate mitigation measures are not applied. However, the Site will be operated in accordance with the DEMP, relevant legislation, regulations, licence/permit and standard industry practices to mitigate the potential impacts.

21.5.33 There is potential for run-off associated with stockpiled material that is not covered, which may migrate to nearby surface watercourses and groundwater beneath the Site if appropriate mitigation measures are not applied. However, the Site will be operated in accordance with the DEMP, relevant legislation, regulations, licence/permit and standard industry practices to mitigate the potential impacts.

21.6 Preliminary Assessment of Residual Effects

Construction

21.6.1 Based on the current understanding of ground conditions and land quality at the Site and based on the implementation of the embedded and standard mitigation measures as detailed herein, this preliminary assessment of effects for the Project has concluded that the residual impact varies between Neutral Adverse and Slight Adverse. A summary of the residual impact for each receptor is presented in **Table 21.12**.

21.6.2 It is anticipated that any potential impacts associated with construction phase will be localised and short term as the works will be undertaken in compliance with the CEMP and environmental good practice. This will minimise the potential risk to off-site human health receptors and receptors on the Site. Any previously unidentified contamination that could be mobilised or disturbed during the construction phase is therefore considered to present a neutral to slight magnitude of impacts. If the previously unidentified contamination is identified and remediated, this may present a slight beneficial effect to the geology and soils.

21.6.3 The construction phase may result in the mobilisation of contaminants that could impact human health and could create preferential pathways to groundwater, particularly during any earthworks on the Site. However, it is anticipated that the mitigation measures outlined in **Section 21.4** and **Table 21.12** will reduce the residual impact associated with these pathways.

Operation

21.6.4 Based on the current understanding of ground conditions and land quality at the Site, and based on the implementation of the embedded and primary, secondary and tertiary mitigation measures as detailed in **Section 21.4**, this preliminary assessment of effects for the Project has concluded that the residual impact varies between Neutral Adverse and Slight Adverse. A summary of the residual impact for each receptor is presented in **Table 21.12**. It is considered that the operational phase of the Project will be operated in accordance with best practice guidance, the relevant legislation and regulations, an Environmental Permit and site-specific health and safety documentation.

Decommissioning

21.6.5 Based on the current understanding of ground conditions and land quality at the Site, it is considered that the impact significance during the decommissioning phase prior to the implementation of mitigation measures varies between Neutral

Adverse and Moderate Adverse. A summary of the impact significance for each receptor is presented in **Table 21.12**

21.6.6 Based on the implementation of the embedded and standard mitigation measures as detailed in **Section 21.4**, this preliminary assessment of effects for the Project has concluded that the residual impact varies between Neutral Adverse and Slight Adverse. A summary of the residual impact for each receptor is presented in **Table 21.12**.

21.7 Summary of Preliminary Assessment

21.7.1 In summary, the potential receptors of the Project include human health, geology, soils, controlled waters and development infrastructure.

21.7.2 The preliminary assessment demonstrates that the construction phase, operational phase and decommissioning phase will result in Neutral to Slight Adverse impacts on the identified receptors following the implementation of embedded mitigation measures. A summary of the residual effects and mitigation measures is provided in **Table 21.12**.

21.7.3 The final outcomes of the likely significant effects of the Project on ground conditions and land quality will be reported within the Environmental Statement.

Table 21.12: Summary of impact pathways, mitigation measures and residual effects

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
Construction Phase					
Human Health Onsite workers Site visitors	Direct contact with contaminated soils, exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Moderate Adverse	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. If asbestos is encountered, an AMP will be prepared and implemented. A GI will be undertaken at the site to obtain data on geotechnical and geo-environmental conditions which will be completed prior to the submission of the ES. The GI data will be used to inform land contamination risk assessments. A Remediation Strategy will be prepared to define mitigation measures for significant contamination and will outline how earthworks will be undertaken. If asbestos is encountered in the GI, an AMP will be prepared and implemented. An MMP will also be implemented to classify, track, store, dispose and potentially re-use excavated materials encountered.	Slight Adverse	High
Human Health Offsite workers site visitors	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived	Moderate Adverse	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	Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
	vapours and ground gas.		Publication C762 (Ref 21-35) to minimise dust generation off-site. A GI will be undertaken at the site to obtain data on geotechnical and geo-environmental conditions which will be completed prior to the submission of the ES. The GI data will be used to inform land contamination risk assessments. A Remediation Strategy will be prepared to define mitigation measures for significant contamination and will outline how earthworks will be undertaken. If asbestos is encountered in the GI, an AMP will be prepared and implemented. An MMP will also be implemented to classify, track, store, dispose and potentially re-use excavated materials encountered.		
Geology Beach and Tidal Flat Deposits Tidal Flat Deposits Devensian Till Flamborough Chalk Formation	Piling foundations	Slight Adverse	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. Environmental good practice will be adhered to on site. A GI will be undertaken at the site to obtain data on geotechnical and geo-environmental conditions which will be completed prior to the submission of the ES.	Neutral Adverse	High
Soils Beach and Tidal Flat Deposits	Spoil arising from earthworks and excavations and degradation due to plant heavy plant	Moderate Adverse	An Agricultural Land Classification Survey will be undertaken to confirm the subgrades of Grade 3 land prior to the submission of the ES. A GI will be undertaken at the Site to obtain site-specific geotechnical and geo-	Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
Tidal Flat Deposits	machinery and vehicle movement. Loss of potential versatile agricultural land.		environmental data and will be completed prior to the submission of the ES. The following standards will be adhered to during earthworks operations: with BS1997:2004 Eurocode 7 (Ref 21-33), BS16907-1 to 7:2018 Earthworks (Ref 21-32); BS6031:2009 Code of Practice for earthworks (Ref 21-33) and National Highways (NH) guidelines including DMRB Series 600 'Earthworks' (Ref 21-34). A Remediation Strategy will be prepared and implemented. Any surplus material will be re-used where possible subject to the requirements within the Remediation Strategy and MMP.		
Groundwater (Superficial Contamination) Beach and Tidal Flat Deposits (Secondary Undifferentiated Aquifer)	Vertical and lateral migration of contaminants via groundwater and surface run-off associated with: Potential vertical migration of spills and leakages. Potential for contaminant mobilisation during construction. Potential for creation of new preferential	Moderate Adverse	The GI will obtain geo-environmental data including groundwater levels and quality and will be completed prior to the submission of the ES. The GI data will inform the land contamination risk assessments. 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 protect the aquifer if there is potential to cause pollution. A hydrogeological assessment and a	Neutral / Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
	pathways and contaminant pathways. This may arise from piling, exposure of soils, increased rainwater infiltration due to ground cover changes and excavations.		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. Potential for creation of new preferential	Moderate Adverse	The GI will obtain geo-environmental data including groundwater levels and quality and will be completed prior to the submission of the ES. The GI data will inform the land contamination risk assessments. 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 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.	Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
	pathways e.g. during piling.				
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. Direct disturbance of the riverbed or bank.	Moderate Adverse	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 suitability 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 Quality, Coastal Protection, Flood Risk and Drainage discusses further guidance relating to the control of water pollution from construction sites.	Slight Adverse	High
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	Moderate Adverse	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 suitability 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 Quality, Coastal Protection, Flood Risk and Drainage	Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
	Habrough Marsh Drain to the west of the Site. This may affect the wider North Beck Drain catchment.		discusses further guidance relating to the control of water pollution from construction sites.		
Operational Phase					
Human Health (Contamination) Future on site workers	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Moderate Adverse	Operations will be required to comply with the relevant legislation and regulations, including 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.	Slight Adverse	High
Human Health (Contamination) Future site visitors Off-site workers	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Moderate Adverse	The human health of future site visitors and off-site workers does not require mitigation measures as the operation of the proposed development 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	Neutral / Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
			any effects to off-site workers and future site visitors.		
Geology (Contamination) Superficial Deposits and Bedrock	Exposure to potential contaminants arising from spillages and leakages on the Site that migrate vertically into the geology underlying the Site.	Slight Adverse	No mitigation measures are required as the Site will be covered in hardstanding / impermeable surfacing, and it is assumed that the Site will be operated in accordance with an Environmental Permit and Hazardous Substance Consents.	Neutral Adverse	High
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.	Moderate Adverse	It is anticipated that 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 discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses.	Slight Adverse	High
Development Infrastructure	Potential for exposure to potential contaminants in soil, leachate,	Moderate Adverse	It is anticipated that buildings and services will be designed to use concrete and service pipes that are appropriate to any aggressive ground conditions at the Site. The design and	Neutral / Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
Buildings and services	groundwater and accumulation of ground gas.		build of structures will also incorporate ground gas protection measures suitable for the ground gas conditions at the Site.		
Decommissioning Phase					
Human Health (Contamination) Future site workers	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours.	Moderate Adverse	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.	Slight Adverse	High
Human Health (Contamination) Off-site workers Site visitors	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours.	Moderate Adverse	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.	Slight Adverse	High
Geology (Contamination) Superficial Deposits and Bedrock	Exposure to potential contaminants arising from spillages and leakages on the Site that migrate vertically into the geology underlying the Site.	Moderate Adverse	Works will comply with best practice guidance and the DEMP for the Site.	Neutral Adverse	High
Controlled Waters (Contamination)	Surface run-off and lateral / vertical migration arising from potential	Moderate Adverse	Works will comply with best practice guidance and the DEMP for the Site. Material stockpiles will be located a suitable distance from watercourses and will be suitably	Neutral / Slight Adverse	High

Receptor	Impact Pathway	Effects before Mitigation Measures	Mitigation Measure	Effect	Confidence
Superficial Secondary Aquifer Principal Bedrock Aquifer Humber Estuary North Beck Drain and wider catchment (including the Habrough Marsh Drain)	accidental spillages and leakages from handling of fuels, lubricants, stored chemicals may impact surface waters and groundwater.		covered if not used within three months to prevent mobilisation and run-off.		

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21.9 Abbreviations and Glossary of Terms

Table 21.2 Glossary and Abbreviations

Term	Acronym	Meaning
Agricultural Land Use Classification	ALC	The system devised and introduced by the Ministry of Agriculture, Fisheries and Food to classify agricultural land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. Land is graded between 1 (excellent quality) to 5 (very poor quality), with grade 3 subdivided into agricultural subgrades 3a and 3b.
Asbestos Management Plan	AMP	An Asbestos Management Plan details the location of asbestos and outlines how the presence of asbestos will be managed on site.
Aquifer	-	An underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand or silt).
Baseline	-	The environment as it appears (or would appear) immediately prior to the implementation of the project together with any known or foreseeable future changes that would take place before completion of the project.
Bedrock	-	Rock that underlies loose deposits such as soil or alluvium.
Below ground level	BGL	Term used to differentiate below ground from above ground.
Borehole	-	A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground.
British Geological Survey	BGS	A body which aims to advance geoscientific knowledge of the United Kingdom landmass and its continental shelf by means of systematic surveying, monitoring and research.
California Bearing Ratio	CBR	A geotechnical test conducted to assess the strength condition of a soil. The results of CBR tests are often used in road pavement design.
Construction Environmental Management Plan	CEMP	A Construction Environmental Management Plan describes the specific mitigation measures to be followed by the appointed construction contractor to reduce potential nuisance impacts.

Term	Acronym	Meaning
Control of Major Accidents and Hazards Regulations 2015	COMAH	The Control of Major Accidents and Hazards Regulations 2015 aims to prevent and mitigate the effects of major accidents involving dangerous substances which can cause serious damage/harm to people and/or the environment.
Conceptual Site Model	-	A representation of the characteristics of the Site and indicates potential source areas of contamination, pathways and receptors (including human health, groundwater, surface water, ecology and buildings / infrastructure). It is used to identify potentially complete source-pathway-receptor (S-P-R) contaminant linkages.
Development Consent Order	DCO	The consent for a Nationally Significant Infrastructure Project required under the Planning Act 2008
Department for Environment, Food and Rural Affairs	Defra	The Government department responsible for policy and regulations on environmental, food and rural issues.
Decommissioning Environmental Management Plan	DEMP	A Decommissioning Environmental Management Plan describes the specific mitigation measures to be followed by the appointed construction contractor to reduce potential nuisance impacts during decommissioning.
Design Manual for Roads and Bridges	DMRB	The Design Manual for Roads and Bridges contains information about current standards relating to the design, assessment and operation of motorway and all-purpose trunk roads in the United Kingdom.
Design Sulphate Class	DS	A site classification based on the determined sulphate (including potential sulphate) contents of the ground and/or groundwater.
Drinking Water Standard	DWS	Evaluation criteria for groundwater to determine if the level of contaminant in groundwater is acceptable.
Environment Agency	EA	Government agency established to protect and improve the environment and contribute to sustainable development in England. Responsibilities include water quality and resources, flooding and coastal risk management and contaminated land.
Environmental Impact Assessment	EIA	The statutory process through which the likely significant effects of a development project in the environment are identified and assessed.
Environmental Quality Standards	EQS	The maximum permissible concentration of a potentially hazardous chemical.
Environmental Statement	ES	A statutory document which reports the EIA process, produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.

Term	Acronym	Meaning
Generic Assessment Criteria	GAC	Criteria used in screening assessments for human health and controlled waters. The criteria state the maximum permissible concentration of a potentially hazardous chemical and takes into account the concentration of a substance, site characteristics, and the source-pathway-receptor behaviour.
Geology	-	The physical structure, substance and history of the earth (rocks and minerals).
Geotechnical Data	-	Properties of soil and/or rock which are used in engineering design.
Glacial Till	-	Unsorted and unstratified material deposited by glacial ice.
Groundwater	-	Water found underground in porous geological strata and soils.
Groundwater Dependent Terrestrial Ecosystems	GWDTE	These ecosystems are wetlands which critically depend on groundwater flows. They are protected by the Water Framework Directive.
Ground Investigation	GI	An intrusive investigation undertaken to collect information relating to the ground conditions, normally for geotechnical or land contamination purposes.
Hazard	-	A substance, operation or piece of equipment which has the potential to cause harm to people or the environment.
Highways England Water Risk Assessment Tool	HEWRAT	This tool is an Excel application which assesses acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment-bound pollutants respectively.
Internal Drainage Board	IDB	A public body that manage water levels in an area, known as an internal drainage district, where there is a special need for drainage.
Institute of Environmental Management and Assessment	IEMA	A professional body for practitioners working in the fields of environmental management and assessment.
Land Contamination Risk Management	LC:RM	The Environment Agency guidance that must be adhered to associated with the assessment and management of the risks from land contamination.
Landscape Character Area	LCA	Areas of landscape that have a broadly consistent pattern of topography, land use and vegetation cover.

Term	Acronym	Meaning
Local Geological Site	LGS	Non-statutory geological sites considered worthy of protection for their earth science or landscape importance. Formerly known as Regionally Important Geological Sites.
Made Ground	-	Land where natural and undisturbed soils have largely been replaced by man-made or artificial materials. It may be composed of a variety of materials including imported natural soils and rocks with or without residues of industrial processes (such as ash) or demolition material (such as crushed brick or concrete).
Multi-Agency Geographic Information Service	MAGIC	A website which provides geographic information about the natural environment.
Materials Management Plan	MMP	A Materials Management Plan outlines how excavated material can be reused on site, including the classification, tracking, storage and disposal of excavated material.
National Nature Reserve	NNR	National Nature Reserves were established to protect some of our most important habitats, species and geology, and to provide ‘outdoor laboratories’ for research.
National Planning Policy Framework	NPPF	A planning framework which sets out the Government's planning policies for England and how these are expected to be applied.
National Policy Statement for Ports	NPSfP	The National Policy Statement for Ports provides the framework for decisions on proposals for new port development.
Nationally Significant Infrastructure Project	NSIP	A type of project listed in the Planning Act 2008, which must be consented by a Development Consent Order.
North-East Lincolnshire Council	NELC	Local authority of North-East Lincolnshire.
Nitrate Vulnerable Zone	-	Areas covering 62% of England designated as a result of the EU's Nitrates Directive in order to reduce the level of nitrates in surface and groundwater. Farmers with land in nitrate vulnerable zones have to follow mandatory rules to tackle nitrate loss from agriculture.
Ordnance Survey	OS	The national mapping agency for the UK.
Polybrominated Diphenyl Ethers	PDBE	Polybrominated diphenyl ethers are a group of man-made organobromine compounds.
Preliminary Environmental Information Report	PEIR	A report that compiles and presents the Preliminary Environmental Information gathered for a project.

Term	Acronym	Meaning
Perfluorooctane Sulphonate	PFOS	Perfluorooctane sulphonate belongs to a large, diverse group of man-made substances known collectively as perfluoroalkyl and polyperfluoroalkyl substances.
Principal Aquifer		Aquifers previously designated as major aquifer.
Ramsar	-	Wetlands of international importance designated under the Ramsar Convention.
Risk	-	The likelihood of a specified level of harm occurring within a specified period of time.
Regionally Important Geological Sites	RIGS	Regionally Important Geological Sites are sites of regional and local importance for their geology that have not been designated a Site of Special Scientific Interest.
Remediation Strategy	-	A Remediation Strategy is the overarching plan developed to achieve the remediation objectives agreed at the outset.
Scottish Environment Protection Agency	SEPA	Scotland's environmental regulator and national flood forecasting, flood warning and strategic flood risk management authority,
Site of Special Scientific Interest	SSSI	Area of land notified by Natural England under section 28 of the Wildlife and Countryside Act 1981 as being of special interest due to its flora, fauna or geological or physiological features.
Source Protection Zone	SPZ	Zones defined by the Environment Agency to protect groundwater sources such as wells, boreholes and springs from potential contamination.
Special Area of Conservation	SAC	Sites designated under EU legislation for the protection of habitats and species considered to be of European interest.
Special Protection Area	SPA	Sites designated under the European Directive on the Conservation of Wild Birds for the protection of birds in member states.
Superficial Deposit	-	A geological deposit that was laid down during the Quaternary period. Such deposits were largely formed by river, marine or glacial processes but can also include wind-blown deposits known as loess.
Tidal Flat Deposits	-	Soil deposits formed from mud flats in the intertidal zone.
United Nations Educational, Scientific and Cultural Ogranisation	UNESCO	A specialized agency of the United Nations aimed at promoting world peace and security through international cooperation in education, arts, sciences and culture.

Term	Acronym	Meaning
Unproductive Strata	-	Soil and/or rock layers with low permeability that have negligible significance for water supply or base flow for rivers.
Waste Acceptance Criteria	WAC	The criteria outlines the disposal requirements of waste to relevant landfill categories (hazardous, non-hazardous and inert). WAC samples are tested in a laboratory to determine which landfill category is suitable.
Waste Framework Directive	Waste FD	The Waste Framework Directive sets the basic concepts and definitions related to waste management, including definitions of waste, recycling and recovery.
Water Framework Directive	WFD	A European Union Directive which commits member states to achieve good status of all waterbodies (both surface and groundwater), and also requires that no such waterbodies experience deterioration in status. Good status is a function of good ecological and good chemical status, defined by a number of elements.