

# IMMINGHAM EASTERN RO-RO TERMINAL



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Chapter 12: Ground Conditions Including Land Quality  
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# Immingham Eastern Ro-Ro Terminal

Environmental Statement: Volume 1

Chapter 12: Ground Conditions Including Land Quality

December 2022



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# 12 Ground Conditions including Land Quality

## 12.1 Introduction

- 12.1.1 This chapter provides an assessment of the potential significant effects of the proposed Immingham Eastern Ro-Ro Terminal (IERRT) on ground conditions and land quality. The principal landside elements of the IERRT project are shown on Figure 1.3 in Volume 2 of this Environmental Statement (ES) (Application Document Reference number 8.3). This chapter has been prepared by AECOM Limited.
- 12.1.2 The following receptors have been considered as part of the assessment:
- Human health;
  - An ecological system, or organism within such system, within a location that has been identified for protection under European, national and local designations (including Special Protection Area (SPA), Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), and Ramsar sites);
  - Geology: Made Ground, superficial deposits and bedrock;
  - Property in the form of buildings and services; and
  - Controlled waters (surface water courses and groundwater).
- 12.1.3 Figures 12.1, 12.2a, 12.2b and 12.3 in Volume 2 of ES (Application Document Reference number 8.3) to this ES show the study area, site geology, and groundwater abstractions, respectively.
- 12.1.4 Whilst the review of baseline conditions focuses on the geological and hydrogeological setting, it also considers the wider environment in terms of identifying potential receptors that could be impacted by any existing or soil and/ or groundwater contamination. There is, therefore, some reference made to hydrological and ecological features in this chapter. These are, however, discussed in more detail within the following chapters of this ES: Chapter 7 Physical Processes; Chapter 8 Water and Sediment Quality; Chapter 9 Nature Conservation and Marine Ecology and Chapter 11 Coastal Protection, Flood Defence and Drainage.
- 12.1.5 This chapter of the ES describes the impacts and effects that may arise as a result of the IERRT project on ground conditions and land quality and describes a number of measures designed to mitigate any potential effects. This chapter references the requirement for the development of and adherence to the following:
- A Construction Environmental Management Plan (CEMP) (Application Document Reference number 9.2), which incorporates a Waste Management Plan, identifies the steps proposed in order to mitigate the potential effects during construction; and

- An Outline Remediation Strategy (Appendix 12.4 in Volume 3 of the ES (Application Document Reference number 8.4)) which sets out how the earthworks stage of construction would be undertaken and how remedial works would be undertaken, if necessary.

## 12.2 Definition of the study area

- 12.2.1 The study area for this assessment is the area over which potential direct and indirect effects of the IERRT project are predicted to occur during the construction (including demolition) and operational periods.
- 12.2.2 Direct effects on ground conditions are those that may arise due to accidental release of contaminants during construction and/ or operation of the IERRT project.
- 12.2.3 Indirect effects involve disturbing the ground in such a way that contaminant linkages (source-pathway-receptor) are created, for example, 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.
- 12.2.4 The study area for the ground conditions including land quality is considered to be the landside area of the IERRT project site boundary, along with a buffer extending 250 m around the site in order to identify potential off-site sources of contamination and land stability issues which together will inform the baseline condition within, and adjacent to, the site. This includes the Made Ground adjacent to the site and within the Port, geological deposits underlying Made Ground and any natural ground underlying surface water bodies within 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.
- 12.2.5 The extent of the study area is shown on Figure 12.1 of this ES. Figures 12.2a, 12.2b and 12.3 of this ES present the geology and existing groundwater abstractions at the IERRT project site. The IERRT project site is divided into three Sub Plots: Sub Plot 1 comprises the northernmost part of the site; Sub Plot 3 comprises the south-east area and Sub Plot 4 comprises the southern-western area as presented in Figure 1 in the Phase 1 Desk Study provided in Appendix 12.1 in Volume 3 of the ES (Application Document Reference number 8.4). Additional areas of the site include a section of the A1173 Queens Road and the land associated with Long Wood. Sub Plot 2 which is located to the east of the IERRT project site and was originally included as part of the IERRT project. However, this Sub Plot has been scoped out of the IERRT project site and is therefore no longer considered in this ES.



- 12.2.6 These are considered to be appropriate study areas for the assessment of geotechnical and geochemical aspects in accordance with the methodology set out in Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (Highways England, 2019). This guidance has been used for this assessment as it is the only accepted industry standard document and is considered applicable to the proposed development. A study zone of 250 m radius for off-site sources of potential contamination and land stability issues are considered appropriate; and a 1 km radius for the assessment of controlled waters, (as opposed to ground conditions which as noted above is 250 m) extends a far enough distance from the site to be able to consider contamination migration risks, the location of potential contaminants and the location and nature of on-site and offsite potential receptors (as noted in LA 109 Geology and Soils (Highways England, 2019)). This is based on professional judgement by competent experts with relevant and appropriate experience of assessing land contamination and contamination dispersion.
- 12.2.7 Factors that affect the extent of the study area will be dependent on the proposed intrusive works including but not limited to excavation, infill and piling/ construction of foundations. These activities have the potential to disturb the underlying geology and existence of Made Ground. Any localised contamination present has the potential to migrate, and the use of piled foundations has the potential to create new pathways for contaminant migration to underlying aquifers.

## 12.3 Assessment methodology

### Data and information sources

- 12.3.1 Current baseline conditions have been determined by a desk-based review of available information supplemented by a walk-over of Sub Plots 1, 3 and 4. A Phase 1 Desk Study was prepared by AECOM dated November 2022 (Appendix 12.1 to this ES) and should be read in conjunction with this chapter. The area of the site located on a section of the A1173 Queens Road and the land associated with Long Wood were not accessed as part of the walk-over. The south-east corner of Sub Plot 1 was not accessed at the time of writing the Desk Study as this area is leased to a tenant and was, therefore, inaccessible. This is not considered to be a limitation for the consideration of baseline conditions as the desk-based study presents sufficient information on the ground conditions and features on the site. A site walkover is considered to be an addition to the desk-based study. The baseline conditions have also been determined through a review of an existing Factual Ground Investigation Report undertaken by GD Pickles dated April 2020 (Appendix 12.2 of this ES) and the AECOM Phase 2 Ground Investigation Report dated November 2022 (Appendix 12.3 of this ES).
- 12.3.2 The main desk-based sources of information that have been reviewed to inform the current baseline description include:

- Google Maps website [REDACTED]
- British Geological Survey (BGS) GeoIndex Online [REDACTED]
- The Coal Authority Interactive Map Viewer [REDACTED]
- BGS GeoRecords Plus interactive map [REDACTED]
- MAGIC website <http://magic.defra.gov.uk/> (Accessed: July 2022);
- BGS Solid and Drift for Partington (Sheet 81 (and including parts of Sheet 82 and 90) 1:50,000;
- UK Radon website [REDACTED] (Accessed: July 2022); and
- Soil Survey of England and Wales (1983). 1:250,000 scale Soil Map of Northern England.

12.3.3 The baseline characterisation provided by the desktop survey within the Phase 1 Desk Study (AECOM, 2022) (Appendix 12.1 to this ES), the GD Pickles Factual Report (April 2020) (Appendix 12.2 of this ES) and the AECOM Phase 2 Ground Investigation Report (November 2022) (provided as Appendix 12.3 of this ES) report are considered sufficient to inform the assessment.

12.3.4 A confirmatory GI has been undertaken which includes provision for ongoing monitoring works as is normal for a project such as the IERRT. In light of the need to include ongoing monitoring the current GI factual report has been issued in draft. A review of the initial draft of the report has, however, been undertaken which does not alter the assessments already incorporated within this chapter of the ES. In the event that any geo-environmental risks are identified following receipt of the final factual report, which will include the results of the final round of monitoring, as well as the conclusion of the assessment then in accordance with guidance in LC:RM (Environment Agency, 2021), appropriate mitigation measures as necessary will be incorporated in the final remediation strategy for the project, the outline for which is provided as Appendix 12.4.

## Determining significance of effects

12.3.5 In order to facilitate the impact assessment process and ensure consistency with industry standard guidance in the terminology used to describe significance, an industry standard assessment methodology has been applied. This methodology has been developed using a range of guidance, as explained below.

12.3.6 Assessment of receptor value (sensitivity) for geology, soils and contamination follows the procedure described in Table 3.11 of the Highways England DMRB Sustainability & Environmental Appraisal, LA 109 Geology and Soils (Highways England, 2019).

- 12.3.7 Assessment of receptor value (importance) for groundwater resources follows the procedure described in Table 3.70 of the Highways England DMRB Sustainability & Environmental Appraisal LA 113, Road drainage and the water environment (Highways England, 2020a).
- 12.3.8 The value (sensitivity or importance) of a resource ranges from ‘negligible’ to ‘very high’ and is dependent on the assessment area or features of importance and conservation value. The criteria for determining the value of a resource and typical examples for geology, soils, contamination, and groundwater are given in Table 12.1 to this chapter of this ES.
- 12.3.9 Resources assessed to have a value (sensitivity) of medium or higher are assessed against likely impacts, effects, and mitigation measures in Sections 12.8 and 12.9 of this chapter, respectively.

**Table 12.1. Sensitivity (value) of geology and soil receptors, and water environment attributes**

Level of Sensitivity	Example of Definitions of Sensitivity for Different Receptors	
	Receptors Susceptible to Land Contamination	Soil and Geological Receptors
Very high	<ul style="list-style-type: none"> <li>• Human health: very high sensitivity land use such as residential or allotments.</li> <li>• Surface water: Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) and <math>Q95 \geq 1.0 \text{ m}^3/\text{s}</math>. Site protected/designated under European Commission (EC) or UK legislation SAC, SPA, SSSI, Ramsar site, salmonid water)/ Species protected by EC legislation LA 108 (Highways England, 2020c).</li> <li>• Groundwater: Principal aquifer providing a regionally important resource and/ or supporting a site protected under EC and UK legislation LA 108 (Highways England, 2020c). Groundwater locally supports Groundwater Dependant Terrestrial Ecosystems (GWDTE) SPZ1</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: very rare and of international importance with no potential for replacement (e.g., United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Sites, UNESCO Global Geoparks, SSSIs and Geological Conservation Review (GCR) where citations indicate features on international importance). Geology meeting international designation citation criteria which is not designated as such.</li> <li>• Soils directly supporting a European Union (EU) designated site (e.g., SAC, SPA, Ramsar site).</li> </ul>

Level of Sensitivity	Example of Definitions of Sensitivity for Different Receptors	
	Receptors Susceptible to Land Contamination	Soil and Geological Receptors
High	<ul style="list-style-type: none"> <li>• Human health: high sensitivity land use such as public open space.</li> <li>• Surface water: Watercourse having a WFD classification shown in a RBMP and Q95</li> <li>• Groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem. The groundwater is within a Source Protection Zone (SPZ) 2 which is defined by the Environment Agency 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”.</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: rare and of national importance with little potential for replacement (e.g., geological SSSI, ASSI (area of special scientific interest), National Nature Reserves (NNR)). Geology meeting national designation criteria which is not designated as such.</li> <li>• Soils directly supporting a UK designated site (e.g., SSSI).</li> </ul>
Medium	<ul style="list-style-type: none"> <li>• Human health: medium sensitivity land use such as commercial or industrial.</li> <li>• Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 &gt;0.001 m<sup>3</sup>/s</li> <li>• Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface water. This is within a SPZ3 which is defined by the Environment Agency as the “area around a supply source within which all 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”.</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: of regional importance with limited potential for replacement e.g., Regionally Important Geological Sites (RIGS). Geology meeting regional designation criteria which is not designated as such.</li> <li>• Soils supporting non-statutory designated sites (e.g., Local Nature Reserve (LNR), Local Geological Sites (LGSs), Sites of Nature Conservation Importance (SNCIs).</li> </ul>

Level of Sensitivity	Example of Definitions of Sensitivity for Different Receptors	
	Receptors Susceptible to Land Contamination	Soil and Geological Receptors
Low	<ul style="list-style-type: none"> <li>• Human health: low sensitivity land use such as highways and rail.</li> <li>• Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 <math>\leq 0.001 \text{ m}^3/\text{s}</math></li> <li>• Groundwater: Unproductive strata</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: of local importance/ interest with potential replacement (e.g., non designated geological exposures, former quarries/ mining sites).</li> <li>• Soils supporting non-designated notable or priority habitats.</li> </ul>
Negligible	<ul style="list-style-type: none"> <li>• Human health: undeveloped surplus land/no sensitive land use proposed.</li> <li>• Surface water: Receptor is resistant to change and is of little or no environmental value.</li> <li>• Groundwater: Receptor is resistant to change and is of little or no environmental value.</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: no geological exposures, little/no local interest.</li> <li>• Soils: previously developed land formerly in 'hard uses' with little potential to return to agriculture.</li> </ul>

Source: Adapted from DMRB LA 109 Table 3.11 (Highways England, 2019) and DMRB LA 113 Table 3.70 (Highways England, 2020a) therein

## Magnitude of impacts

12.3.10 The magnitude of potential impact upon geology and soils receptors considers the scale of the predicted change to baseline conditions and where there are potential pathways between an impact source/ hazard and identified receptors. This takes into account the spatial scale of the impact, as well as its duration and reversibility (e.g., the impact magnitude may be moderated if the impacts are temporary rather than permanent; or are reversible rather than irreversible).

12.3.11 The magnitude of impact on a receptor ranges from 'no change' to 'major'. The criteria for determining the magnitude of impact on a receptor are given in Table 12.2.

**Table 12.2. Magnitude of impact - geology and soils**

Magnitude of Impact	Example of Adverse Magnitudes	
	Receptors Susceptible to Land Contamination	Soil and Geological Receptors
Major	<ul style="list-style-type: none"> <li>• Human health: significant contamination identified. Contamination levels significantly exceed background levels and relevant</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: loss of geological feature/ designation and/or quality and integrity, severe damage to key characteristics, features or elements.</li> </ul>

Magnitude of Impact	Example of Adverse Magnitudes	
	Receptors Susceptible to Land Contamination	Soil and Geological Receptors
	<p>screening criteria (e.g., category 4 screening levels - SP1010 (Contaminated Land: Applications in Real Environments (CL:AIRE, 2014)). Potential for significant harm to human health. Contamination heavily restricts future use of land.</p> <ul style="list-style-type: none"> <li>• Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> <li>• Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> </ul>	<ul style="list-style-type: none"> <li>• Soils: physical removal or permanent sealing of soil resource or agricultural land.</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>• Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g., category 4 screening levels SP1010). Significant contamination can be present. Control/remediation measures are required to reduce risks to human health/ make land suitable for intended use.</li> <li>• Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> <li>• Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: partial loss of geological feature/ designation, potentially adversely affecting the integrity; partial loss of/ damage to key characteristics, features or elements.</li> <li>• Soils: 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.)</li> </ul>
Minor	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Surface water: use sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>• Geology: minor measurable change in geological feature/ designation attributes, quality or vulnerability; minor loss of, or alteration to, one (may be more) key characteristics, features or elements.</li> <li>• Soils: Temporary loss/ reduction of one or more soil function(s) and restriction to current or approved future use (e.g., through degradation,</li> </ul>

Magnitude of Impact	Example of Adverse Magnitudes	
	Receptors Susceptible to Land Contamination	Soil and Geological Receptors
	<ul style="list-style-type: none"> <li>criteria in DMRB LA 113 (Highways England, 2020a).</li> <li>Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> </ul>	<ul style="list-style-type: none"> <li>compaction, erosion of soil resource).</li> </ul>
Negligible	<ul style="list-style-type: none"> <li>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.</li> <li>Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> <li>Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> <li>Soils: no discernible loss/ reduction of soil function(s) that restrict current or approved future use.</li> </ul>
No Change	<ul style="list-style-type: none"> <li>Human health: reported contaminant concentrations below background levels.</li> <li>Surface water; use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> <li>Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a).</li> </ul>	<ul style="list-style-type: none"> <li>Geology: no temporary or permanent loss/ disturbance of characteristics features or elements.</li> <li>Soils: no loss/ reduction of soil function(s) that restrict current or approved future use.</li> </ul>

Source: Adapted from DMRB LA 109 Table 3.12 and Table E/2.1 (Highways England, 2019) therein

## Significance of effects

12.3.12 Once the value (sensitivity) of each resource and the magnitude of the potential impact upon it are established, the significance (effect) matrix from Table 3.8.1 DMRB Sustainability & Environmental Appraisal, LA 104 Environment Assessment and monitoring (Highways England, 2020b) has been used to determine the significance (effect) of the potential impact on the receptor as reported in Table 3.7 of that document. These have been reproduced and are presented as Table 12.3 and Table 12.4 to this chapter of the ES respectively.

**Table 12.3. Significance (Effect) Matrix**

Receptor Value	Magnitude of Impact (degree of change)				
	No Change	Negligible	Minor	Moderate	Major
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

Source: DMRB Table 3.8.1 LA 104 (Highways England, 2020b)

**Table 12.4. Significance Categories (Effects) and Typical Descriptions**

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

Source: DMRB Table 3.7 LA 104 (Highways England, 2020b).

12.3.13 The methodology described above has been used to assess the significance for the two principal stages of the project, namely:

- Construction (including demolition); and
- Operation

12.3.14 Where possible, each effect has been classified both before and after mitigation measures have been applied. Effects remaining after mitigation has been applied are referred to as 'residual effects' and are detailed in Section 12.11 of this ES chapter.

## 12.4 Consultation

12.4.1 Consultation as to whether there are likely to be any ground conditions effects as a result of the construction and operation of the IERRT project has been undertaken at all stages of the IERRT project development. The outcomes of the formal scoping process as well as any feedback received in response to the statutory consultation, oral communication with an



Environmental Protection Officer, and the publication of the Preliminary Environmental Information Report (PEIR) and supplementary statutory consultation and the publication of the Supplementary Consultation Report, have also been taken into account to inform the assessment.

- 12.4.2 The outcome of the consultation that has been undertaken, along with how it has influenced the ground conditions assessment, is presented in Table 12.5 of this ES chapter.

**Table 12.5. Summary of Consultation**

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Environment Agency	Scoping Opinion, October 2021  Appendix 2 Environment Agency response	The Environment Agency are satisfied that sufficient measures have been scoped in for the assessment of the risk posed to controlled waters from potential contamination.	Noted. No action required.
The Coal Authority	Scoping Opinion, October 2021  Appendix 2 The Coal Authority response	The Coal Authority have confirmed the site is located outside the defined Development High Risk Area. Therefore, there is no requirement to consider the coal mining legacy or to consult with the Coal Authority on subsequent planning.	Noted. No action required.
Historic England	Scoping Opinion, October 2021  Appendix 2 Historic England response	Historic England have acknowledged the use of existing geotechnical, geophysical and geoarchaeological data, however, it is stated that specifically acquired survey data should be conducted. Historic England have also stated the need for clarification as to whether further geotechnical data will be obtained, and if any geophysical data will be commissioned for use in the Environmental Statement.	Comments have been discussed and used to inform this chapter.  A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES. A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the ground conditions assessment set out in this chapter of the ES.

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
			<p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p>
<p>Natural England</p>	<p>Scoping Opinion, October 2021</p> <p>Appendix 2 Natural England response</p>	<p>Natural England have stated the need to consider impacts on geological sites and therefore include an assessment of the likely impacts on the geodiversity interests.</p> <p>Natural England have stated the ES should include information on sediment quality and the potential for effects on water quality through suspension of contaminated sediments. The ES should also consider if there will be an increase in the pollution risk to water as a result of construction or operation of the development.</p>	<p>There are no recorded RIGS or Locally important Geological Sites within the IERRT project site boundary.</p> <p>Chapter 8 (Water and Sediment Quality) of this ES addresses comments related to sediment quality and the potential for effects on water quality through suspension of contaminated sediments (see Section 8.8 of Chapter 8 of this ES).</p> <p>This chapter considers pollution risks to water during the construction phase in paragraphs 12.8.34 to 12.8.39 and the operational phase in paragraphs 12.8.48 to 12.8.52. A summary is also provided in Table 12.11 of this ES.</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Planning Inspectorate (PINS)	Scoping Opinion, October 2021  Paragraph 3.3.9	PINS state that specific reference should be made to soil and subsoil pollution produced during the construction and operation phases.	A specific consideration to soil and subsoil pollution pathways and mitigation is presented in Section 12.9 of this chapter alongside the potential impacts to other identified receptors.
PINS	Scoping Opinion, October 2021  Table ID 4.1.5	<p>PINS advise that the ES explains how the baseline data (existing geotechnical and GI data) is derived.</p> <p>If no further GIs occur, the use of the baseline data should be justified as to why it is adequate for the assessment of effects from the IERRT project.</p>	<p>Comments have been discussed and used to inform this chapter.</p> <p>A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES . A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the ground conditions assessment set out in this chapter of the ES.</p> <p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
PINS	Scoping Opinion, October 2021  Table ID 4.7.1	PINS agrees with the justification for best and most versatile agricultural soils and recognises that the IERRT project will be on previously developed land.	Noted. No action required.
PINS	Scoping Opinion, October 2021  Table ID 4.7.2	PINS has acknowledged that ground contamination assessments were desk-based, however, they state that if the desk study indicates that a GI is required, this needs to be undertaken to give confidence to the Examining Authority in a robust assessment with adequate mitigation measures.	<p>Comments have been discussed and used to inform this chapter.</p> <p>A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES . A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the ground conditions assessment set out in this chapter of the ES.</p> <p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Environment Agency	<p>Scoping Opinion, October 2021</p> <p>Appendix 2 Environment Agency response</p>	<p>The Environment Agency are satisfied that sufficient measures have been scoped in for the assessment of the risk posed to controlled waters from potential contamination.</p>	<p>Noted. No action required.</p>
The Coal Authority (PI4)	<p>Statutory Consultation – 19 Jan – 23 Feb 2022</p>	<p>The Coal Authority confirmed that the site is within a coalfield, however, it is not within a Development High Risk Area. There are no hazards associated with a coal mining legacy at shallow depths. Therefore, the Coal Authority suggest the coal mining legacy does not need to be considered in the Environment Impact Assessment and there is no need for further consultation on planning at the site.</p>	<p>Noted. No action required.</p>
ESP Utilities Group Ltd (PI8)	<p>Statutory Consultation – 19 Jan – 23 Feb 2022</p>	<p>ESP Utilities Ltd have confirmed that there are no gas or electricity apparatus in the vicinity of the site and will not be affected by the proposed works. However, it is noted that this notification is only valid for 90 days of the letter date and an enquiry should be re-submitted if proposed works commence after this date.</p>	<p>Noted. No action required.</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
National Grid (PI24)	Statutory Consultation – 19 Jan – 23 Feb 2022	National Grid have confirmed that there is no National Grid Electricity Transmission apparatus and no National Grid Gas apparatus within or in close proximity to the proposed site boundary.	Noted. No action required.
Environment Agency (PI34)	Statutory Consultation – 19 Jan – 23 Feb 2022	The Environment Agency do not have concerns related to the controlled waters risk assessment relating to contamination in Chapter 12 Ground Conditions and Land Quality of the PEIR. The Environment Agency agree with the approach to obtain further GI data to update the Conceptual Model and have no further concerns.	<p>Comments have been discussed and used to inform this chapter.</p> <p>A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES . A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the ground conditions assessment set out in this chapter of the ES.</p> <p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
North Lincolnshire Council (PI38)	Statutory Consultation – 19 Jan – 23 Feb 2022	North Lincolnshire Council's Environmental Protection Officer agrees with the inclusion of a Phase 2 site investigation to support the application. It is noted that further comments from the Environmental Protection team are anticipated.	<p>Comments have been discussed and used to inform this chapter.</p> <p>A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES. A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the ground conditions assessment set out in this chapter of the ES.</p> <p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p>
Anglian Water (PI43)	Statutory Consultation – 19 Jan – 23 Feb 2022	Anglian Water would like confirmation in the ES that there are no contamination risks associated with the Anglian Water abstraction points or sources water is drawn from. It is noted that the closest distance from the IERRT	The Anglian Water abstraction points are not considered to be affected by contamination risks due to the distance from the IERRT project site. This study only incorporates risks to controlled waters up to 1 km.



Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
		<p>project to an abstraction point is 3km.</p> <p>Anglian Water also recommend that Tables 12.10 and 12.11 include the impact from construction from plant and heavy traffic and the requirement to move existing water supply pipelines within the site and local road network.</p>	<p>Impact from construction and heavy traffic is not considered to be a pollutant linkage and is therefore not discussed further in this chapter.</p> <p>Tables 12.10 and 12.11 assess possible pollutant risks and therefore impact from construction from plant and heavy traffic is not carried forward in the assessment. However, it is recommended that where structures are proposed, all utilities/ services equipment will be removed and rerouted where necessary. The location of existing services will be identified, and, if necessary, haul routes will be created to minimise/ remove potential impact on services/ utilities above or below ground.</p>
<p>North East Lincolnshire Council (PI45)</p>	<p>Statutory Consultation – 19 Jan – 23 Feb 2022</p>	<p>North East Lincolnshire Council have stated they are content with the approach to conduct a GI and produce an interpretative report. They do not have any adverse comments.</p>	<p>Comments have been discussed and used to inform this chapter.</p> <p>A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES . A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
			<p>ground conditions assessment set out in this chapter of the ES.</p> <p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p>
<p>North East Lincolnshire Council Environmental Protection Officer</p>	<p>May 2022</p>	<p>The Environmental Protection Officer at North East Lincolnshire Council is content with the approach to conduct an initial ground investigation, followed by a comprehensive ground investigation.</p>	<p>Comments have been discussed and used to inform this chapter.</p> <p>A GI was undertaken in May 2022 to obtain geo-environmental data and has been used to inform the ground conditions assessment set out in this chapter of the ES. A GI was undertaken in Sub Plot 1 and Sub Plot 3 by GD Pickles in 2020 which has also been used to inform the ground conditions assessment set out in this chapter of the ES.</p> <p>A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO)</p>

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
			application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.
The Coal Authority (PI 2)	Supplementary Statutory Consultation – 28 Oct – 27 Nov 2022	The proposed refinements required to facilitate the development at this site does not result in any changes to our previous comments dated 19 January 2022. Accordingly, we have no specific comments to make on this Supplementary Statutory Consultation.	Noted.

## 12.5 Implications of policy legislation and guidance

- 12.5.1 This section of the chapter sets out key aspects and implications of applicable legislation, regulation, policy and guidance that are relevant to the assessment of likely impacts on ground conditions including land quality. It builds upon the overarching chapter covering the Legislation, Policy and Consenting Framework (Chapter 5 of this ES).

### Legislation

- 12.5.2 The UK left the EU on 31 January 2020. The legislation discussed in this section remains applicable to the ground conditions assessment in this ES.

#### *The Water Framework Directive (2000/60/EC)*

- 12.5.3 The WFD is the framework for community action in the field of water policy. The principal objective of the framework 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 framework aims to develop sustainable water use and reduce and eliminate the presence of hazardous substances within water bodies. It must be considered in any scheme that has the potential to have an impact on any part of the water environment. The WFD is implemented in England and Wales through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended).

#### *Groundwater Daughter Directive (2006/118/EC)*

- 12.5.4 The Groundwater Daughter 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 WFD. This is incorporated in The Groundwater (Water Framework Directive) (England) Direction 2016 and implemented in England and Wales through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended).

#### *The Environmental Liability Directive (2004/35/EC)*

- 12.5.5 The Environmental Liability 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. The Directive defines 'damage' as "*a measurable adverse change in a natural resource or measurable impairment of a natural resource service which may occur directly or indirectly*".

- 12.5.6 The Directive defines 'environmental damage' as "*damage to protected species and natural habitats, which is any damage that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species. The significance of such effects is to be assessed with reference to the baseline condition, taking account of the criteria set out in Annex I. Damage to protected species and natural habitats does not include previously identified adverse effects which result from an act by an operator which was expressly authorised by the relevant authorities in accordance with provisions implementing Article 6(3) and (4) or Article 16 of Directive 92/43/EEC or Article 9 of Directive 79/409/EEC or, in the case of habitats and species not covered by Community law, in accordance with equivalent provisions of national law on nature conservation.*"
- 12.5.7 The Directive defines 'water damage' as "*damage that significantly adversely affects:*
- *The ecological, chemical or quantitative status or the ecological potential, as defined in Directive 2000/60/EC, of the waters concerned, with the exception of adverse effects where Article 4(7) of that Directive applies; or*
  - *The environmental status of the marine waters concerned, as defined in Directive 2008/56/EC, in so far as particular aspects of the environmental status of the marine environment are not already addressed through Directive 2000/60/EC".*
- 12.5.8 The Directive defines 'land damage' as "*any land contamination that creates a significant risk of human health being adversely affected as a result of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or micro-organism*".
- 12.5.9 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. The Directive is implemented in England through the Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (as amended).

### ***Dangerous Substances Directive (2006/11/EC) as amended***

- 12.5.10 The Dangerous Substances Directive sets out the measures of pollution caused by certain dangerous substances discharged into the aquatic environment (inland surface water, territorial waters and internal coastal waters). As part of this Directive, List I and List II substances are described, whereby List I substances should be eradicated, and List II substances should be reduced. The Directive was repealed and controls under the WFD used to provide at least the same level of protection. As above, the WFD is incorporated in The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended).

## **Environmental Protection Act 1990 and Part 2A (the Contaminated Land Regime)**

12.5.11 Part 2A of the Environmental Protection Act 1990 (EPA) 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 Environment Act 1995***

12.5.12 The Environment Act 1995 established the Environment Agency and 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 Environment Act 2021***

12.5.13 The Environment Act 2021 provides a post-Brexit set of statutory environmental principles and a legal framework for environmental governance for specific improvement of the environment, including measures on waste and resource efficiency, air quality and environmental recall, water, nature and biodiversity, and provides for the introduction of nature conservation covenants.

### ***The Water Act 2003***

12.5.14 The Water Act 2003 provides measures with regards to holding and issuing licences 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 Act was issued to amend the Water Resources Act 1991 and Water Industry Act 1991.

### ***The Water Act 2014***

12.5.15 The aim of the Water Act 2014 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 licence modifications, waterworks records, flood insurance for households, internal drainage boards, regulations for the water environment and Regional Flood and Coastal Committees.

### ***The Water Resources Act 1991***

12.5.16 The Water Resources Act 1991 gives the Environment Agency powers and duties to prevent or remedy the pollution of controlled waters. Previously under the Act and now under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) it is a criminal offence for a person

to cause or knowingly permit pollution of controlled waters. Sections within the Act refer to water resources management, pollution of water resources, flood defences, fishery controls, financial provisions, land and works powers and information provisions.

### ***Anti-Pollution Works Regulations 1999 (as amended)***

12.5.17 The Anti-Pollution Works Regulations 1999 empower the Environment Agency to serve a notice to remediate or mitigate on *"any person who has caused or knowingly permitted poisonous, noxious or polluting matter or any solid waste to be present in controlled waters"*. The notice will either describe a potential incident and the risk to associated controlled waters, or for a pollution incident that has already occurred, the notice will describe the pollution event. Furthermore, the notice will describe the necessary operations or works which should be carried out.

### ***The Environmental Permitting (England and Wales) Regulations 2016 (as amended)***

12.5.18 The Environmental Permitting (England and Wales) Regulations 2016 (as amended) set out the measures for those carrying out activities that may cause imminent threats of, or actual 'environmental damage', which require a *permit*. These Regulations also outline the authorities responsible for enforcing the Regulations. Such Regulations cover environmental permits, discharge into regulated facilities, enforcement and offences, public registers and powers/ functions of the regulator and authority.

### ***The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (as amended)***

12.5.19 The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (as amended) describe the legal framework for the prevention of environmental damage and requirements for remediation of damage when it occurs. It sets out the UK Government's views on how they should be applied and how particular terms should be interpreted.

### ***The Contaminated Land (England) Regulations 2006 (as amended)***

12.5.20 The Contaminated Land (England) Regulations 2006 (as amended) set out the processes of risk assessment and identification/ evaluation of remediation options.

### ***The Waste (England and Wales) Regulations 2011 (as amended)***

12.5.21 The Waste (England and Wales) Regulations 2011 (as amended) set out the measures required for the prevention, production and management of waste. This describes the purpose of waste prevention programmes with waste prevention measures and makes reference to monitoring by appropriate authorities using qualitative or quantitative benchmarks.

## National policy

### *National Policy Statement for Ports (NPSfP) 2012*

- 12.5.22 The NPSfP (Department for Transport (DfT), 2012) is a framework to address proposals for port development in the UK and associated development (rail and road). It deals primarily with nationally significant infrastructure proposals such as the IERRT project.
- 12.5.23 The NPSfP contains the following relevant policies and guidance:
- 12.5.24 Section 4.7 describes the requirements for an Environmental Impact Assessment (EIA) if projects *“are subject to the European Environmental Impact Assessment Directive”*.
- 12.5.25 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 Environment Agency to determine potential effects, environmental permits and other consents. This section states that the Marine Management Organisation (MMO), the Environment Agency and other relevant regulators should be consulted/ contacted to discuss environmental permits and consents. It is also stated that applicants are encouraged to submit Environmental Permit and other consent applications at the same time as the application for a development consent order.
- 12.5.26 Section 4.15 refers to the requirement for a hazardous substance consent if stocks of hazardous substances above a threshold are held. The Health and Safety Executive should be consulted and will also assess the potential risks. A consultation distance will be set by the Health and Safety Executive therefore it is recommended to consult with the planning authority to determine the potential for the proposed development to be located within the consultation distance of any hazardous substance consent site. It is noted that the Health and Safety Executive should be consulted if the proposed site is located within the consultation distance of any hazardous substance consent site.
- 12.5.27 Section 4.16 refers to the impact of ports on human health, with direct reference to polluting water and hazardous waste. Paragraph 4.16.5 suggests health impacts should be identified and measures to reduce, avoid or compensate adverse health impacts should be identified.
- 12.5.28 Section 5.1 refers to the impacts on biodiversity and geological conservation. As part of this, Paragraph 5.1.4 states that the ES should set out effects on designated geological conservation sites and Paragraph 5.1.5 states that the applicant should demonstrate that the project has conserved or enhanced biodiversity and geological conservation interests. 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. Paragraph 5.1.19 notes that appropriate mitigation measures



form part of the proposed development, including confining the activity to minimal areas during construction and following best practice guidance during construction and operation.

- 12.5.29 Section 5.5 refers to policy on hazardous and non-hazardous waste in the context of protecting human health and the environment, particularly through sustainable waste management and the waste hierarchy. It is also noted that operational waste requirements are considered in the Environment Agency's Environmental Permitting. A Site Waste Management Plan should be produced that details waste recovery and disposal, and the impact on waste management facilities associated with waste arising from the development for at least five operational years. The amount of waste for disposal should be minimised, unless it is considered to be the best environment outcome for waste to be disposed of.
- 12.5.30 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. Paragraph 5.6.4 states that the ES should describe the impacts of the development in water bodies and protected areas under the WFD and abstractions around SPZ.
- 12.5.31 Section 5.8 refers to the potential release of emissions, such as dust, during the construction, operation and decommissioning phases of port infrastructure. The potential release of emissions may cause a statutory nuisance under the Environmental Protection Act (Part III) or may have a detrimental effect on amenity. The potential for dust should be considered as part of an ES and the potential effects on premises or locations should be identified and mitigation measures implemented. It is advised to consult with the planning authority and where required the Environment Agency regarding the assessment methodology.
- 12.5.32 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. This paragraph also notes that the impact on the best and most versatile agricultural land (Agricultural Land Classification Grades 1-3a) should be minimised.

### ***National Planning Policy Framework (NPPF), 2021***

- 12.5.33 The National Planning Policy Framework (NPPF) (Ministry for Housing Communities and Local Government (MHCLG), 2021) sets out the government's planning policies for England and how these are expected to be applied. Although primarily for proposals being taken forward under the Town and Country Planning Act the NPPF is considered to contain policies relevant to the geology and soils assessment. Although the NPPF is not the primary governing policy document for a harbour Nationally Significant Infrastructure Project (NSIP), it is still an important policy document in this topic and has been considered.

- 12.5.34 Paragraphs 183 – 188 form part of a section called ‘Ground conditions and pollution’. Paragraphs relevant to ground conditions and land quality are summarised below.
- 12.5.35 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.
- 12.5.36 Paragraph 184 relates to the responsibility of developers and/or landowners for safe development. The paragraph states that the responsibility for safe development is with the developer and/ or landowner if a site is affected by land stability or contamination.
- 12.5.37 Paragraph 185 refers to minimising the effects of pollution and adverse impacts from the proposed development on health, living conditions, the natural environment and sensitivity of the site.

### ***UK Marine Policy Statement (MPS)***

- 12.5.38 The UK MPS is a framework for Marine Plans and has a particular focus on sustainable development within marine areas. Section 2.6.4 is relevant to the assessment within this chapter, and makes specific reference to increased water demand, water discharges and risk of spillages/ leakages of pollutants during construction and operation. The MPS makes reference to the WFD and the Groundwater Daughter Directive and states that developments should not cause a deterioration of water quality.

### ***East Inshore and East Offshore Marine Plans***

- 12.5.39 Paragraphs 189 and 190 within the East Inshore and East Offshore Marine Plans document make specific reference to chemical water quality, pollution, the WFD and management measures for hazardous substances. Policy ECO2 makes specific reference to the consideration of the potential risk of hazardous substance release associated with increased collision risk. Policy BIO2 refers to the incorporation within development proposals of features that can enhance geological interests. Section 3.11 discusses carbon capture and storage.

## **Local policy**

### ***North East Lincolnshire Local Plan 2013 to 2032 (Adopted 2018)***

- 12.5.40 The following policies of the North East Lincolnshire Local Plan (North East Lincolnshire Council, 2018) are considered to be of some relevance to the ground conditions and land quality assessment:
- Policy 34: Water management. This policy outlines the requirements of development proposals in relation to potential impacts to surface and groundwater. Such requirements include sustainable and adequate water supplies on site, efficient water use, adequate foul water

treatment and appropriate sewerage systems. It is indicated that the Humber River Basin Management Plan should be considered. The Policy also refers to the importance of protecting groundwater within Source Protection Zones during construction and operational phase;

- Policy 41: Biodiversity and Geodiversity. This Policy aims to retain, protect and restore biodiversity value and the ecological network. The protection and enhancement of biological and geological sites are also described within this Policy. Specific reference is made to the Estuary Employment Zone which requires management to protect the biodiversity;

12.5.41 The following local guidance document has also been referred to:

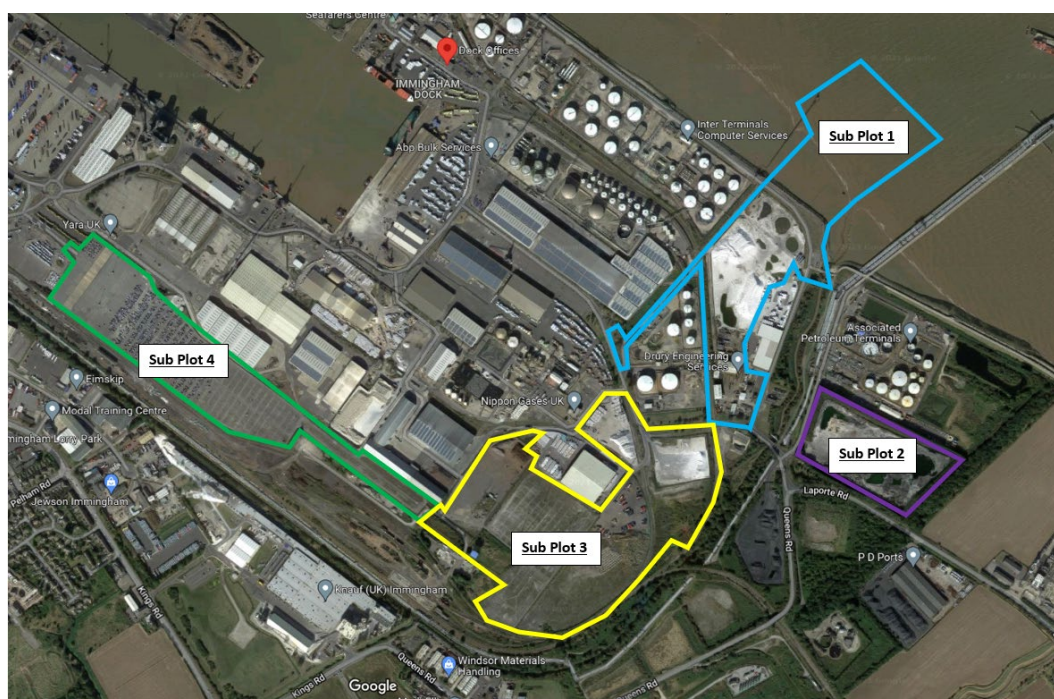
- Yorkshire and Lincolnshire Pollution Advisory Group (2019) Development on Land Affected by Contamination Technical Guidance for Developers, Landowners and Consultants. This document provides guidance for the redevelopment of land that may be contaminated and outlines the required documentation for the Local Planning Authority. The guidance outlines the process for land affected by contamination including Phase 1 Preliminary Risk Assessment, Phase 2 Site Investigation, Phase 3 Remediation and Phase 4 Verification, all of which should be submitted to the Local Planning Authority.

## 12.6 Description of the existing environment

12.6.1 Baseline conditions are set out in the Phase I Geo-environmental and Geotechnical Desk Study Report (AECOM, 2021) (Appendix 12.1 to this ES). Additional information provided in the GD Pickles 2020 report (Appendix 12.2 to this ES) and the AECOM Ground Investigation Report (Appendix 12.3 to this ES), has also been used to inform the baseline conditions at the site.

### Site walk-over of sub-plots 1, 3 and 4

12.6.2 A site walkover of Sub Plots 1 and 3 was undertaken as part of the Desk Study in October 2021. A site walkover of Sub Plot 4 was undertaken in January 2022. General subplot arrangement is presented as Image 12.1 below.



- Sub Plot 2 no longer part of the DCO, sub plot layout arrangement at time of site walkover undertaken (October 2021).

### Image 12.1 General Sub Plot Arrangement

#### Sub plot 1 summary

- 12.6.3 Sub Plot 1 is approximately 13.2 ha and is located at the northern most part of the IERRT project site. The northern section of the plot is within the Humber Estuary where the proposed terminal jetty will be. The remainder of the plot is landside and consists of a mixture of storage areas and warehouses.
- 12.6.4 There is a vacant area between the Humber Estuary and the road, which includes a small area of hardstanding which is used as a car park, and a general waste skip.
- 12.6.5 There are overground pipelines from the adjacent oil terminal which run along the coastline.
- 12.6.6 Immediately east of the plot is a timber yard and warehouse which are outside the site.
- 12.6.7 The central section of the plot is currently a storage yard for imported materials including pumice and blast furnace slag. The current ground surface is a mixture of made ground, bituminous macadam and gravel. Large ponds of rainwater were also noted in various areas across the site. It is understood that this part of the site was previously used as a timber yard.

12.6.8 The southern section of the plot was not accessible during the site visit as it is currently leased to Drury Engineering Services and PK Construction. This is not considered to be a limitation for the baseline assessment as the desk-based survey provides information on the ground conditions at the site. A site walkover is considered to be an addition to the desk-based survey. Several intermediate bulk containers (IBCs), drums and gas canisters were observed which appeared to be stored in a maintenance shed/ yard type building. On the other side of the road which formed the eastern boundary of the plot were two large electrical substations.

### ***Sub plot 3 summary***

12.6.9 Sub Plot 3 is approximately 16.8 ha in area and is situated in the south-east of the site. There are railway sidings within the eastern part of the plot and also running along the eastern boundary. The north-eastern section of the plot consists of a square shaped storage yard which contained stockpiles of pumice at the time of the site visit. Hardstanding was not noted in this area.

12.6.10 The storage yard in the north-western section of the plot is used to store and bag aggregate. This section of the plot was covered in hardstanding.

12.6.11 South of the railway sidings running through the north of the plot is a trailer yard with gravel surfacing. There was one 5,200 litre diesel tank and one gas oil tank (size unknown) in a concrete bund which was noted to be damaged. There were three IBCs located around this area, containing household type waste (no liquids). There were also two old empty fuel tanks and an empty 'corrosive' labelled container discarded within this area.

12.6.12 The south-eastern section of the plot is mostly vacant land, and the surface is gravelly Made Ground with vegetation throughout. In the very south-eastern point of the plot there is a culvert (service corridor) which goes below the site which contained the ports power and water supplies. The western section of the plot consists of two storage areas and an area of grassland. The larger of the two storage areas is used to store newly imported vehicles but was vacant at the time of the site visit. The second area is used as a storage area for timber imports. The ground surface on this section of the plot is hardstanding.

### ***Sub plot 4 summary***

12.6.13 The land within this plot is flat and used for car parking purposes by GB Terminals. Drains were observed in the southern half of the site which flow into an interceptor. No sheen was observed within the drains and therefore no visual evidence of contamination was indicated. Standing water was located within low points of the site. A large drain and fire water tank were located off site to the north. No evidence of contamination was observed in the drains.

12.6.14 The ground cover was estimated to comprise of 42% hardstanding (either macadam or concrete) and 58% gravel chippings. The soil/ geology/ Made

Ground consists of medium to coarse gravel of macadam. No evidence of asbestos containing materials (ACMs) was observed.

- 12.6.15 There was no evidence of spillages, stained ground or discoloured ground observed on the site. Scars in the ground were observed related to service installations, however, there was no evidence of any previous intrusive investigation within the site.
- 12.6.16 The surface was inspected for evidence of previous structures and old foundations. However, there was no indication of such structures. Temporary structures are located on the site, including a metal welfare cabin, metal toilet block, plastic/ fibre glass security hut and plastic/ metal smoking shelter.
- 12.6.17 The only form of vegetation on the site was located on a gravelled area and against the wall of a shed.
- 12.6.18 The following services were observed on the site: water, drains, electricity (lighting and plugs), closed circuit television (CCTV) and communications. A substation was observed off-site to the west.
- 12.6.19 Two waste storage bins were observed on hardstanding during the walkover comprising of a commercial bin and a residential brown bin for North East Lincolnshire Council Waste and cigarette ends were observed on the ground.
- 12.6.20 It was noted that ammoniacal nitrogen storage was in close proximity to the site.
- 12.6.21 The surrounding land use comprises of the Port of Immingham in the north and east; railway sidings for tanker carriage maintenance in the south; fertiliser stores in the east and a materials storage yard and the Port of Immingham in the west. Refineries and chemical plants were also observed near the site and near Knauf (gypsum). An above ground storage tank, possibly for diesel, was observed outside the northern site boundary.

## Previous ground investigations

- 12.6.22 Five GI reports are available for areas of within the site boundary and in areas adjacent to the site boundary and wider Immingham Dock.
- 12.6.23 In 2020, GD Pickles Ltd completed a GI within the area of Sub Plot 1 and Sub Plot 3 (Appendix 12.2 to this ES). The GI comprised six cable percussion boreholes, one rotary percussive borehole and 15 machine excavated trial pits. Two cable percussion boreholes (BH03 and BH05) had monitoring wells installed to monitor groundwater level conditions.
- 12.6.24 No ground gas or groundwater monitoring was undertaken as part of the intrusive GI. Further information on the GD Pickles GI is provided in paragraph 12.6.34.

- 12.6.25 In 1980, Exploration Associates completed a GI for its then owners, the British Transport Docks Board (Exploration Associates, 1980). The investigation comprised of four boreholes to depths between 34.5 m bgl and 40 m bgl on the eastern jetty, located to the northwest of the site. Laboratory testing was only undertaken for geotechnical purposes. Information on the ground conditions encountered as part of the GI is provided in paragraph 12.6.35 of this ES.
- 12.6.26 In 1967, Ground Explorations Ltd completed a site investigation of Immingham for its then owners, the British Transport Docks Board (Ground Explorations Ltd., 1967). Four boreholes were drilled for the intrusive investigation. Most of the boreholes were drilled within the Humber Estuary, however, BH1 was drilled landside and is near to, or within, Sub Plot 1. The offshore boreholes are in close proximity to the area of Sub Plot 1 within the Humber Estuary. Further information on the ground conditions encountered as part of the Ground Explorations Ltd GI is provided in paragraph 12.6.36 of this ES.
- 12.6.27 A GI was undertaken by the British Transport Docks Board in 1965 for the proposed oil jetties at Immingham Dock and South Killingholme (British Transport Docks Board, 1965). The boreholes within Immingham Dock (Habrough Marsh site) were mostly drilled offshore in close proximity to the area of Sub Plot 1 within the Humber Estuary. A total of 17 boreholes were drilled to depths of 30 ft (9.1 m) Below Ordnance Datum (BOD) to 106 ft (32.3 m) BOD. Laboratory testing was limited to geotechnical testing only. The ground conditions encountered in the 1965 GI are summarised in paragraph 12.6.37 of this ES.
- 12.6.28 A GI was undertaken on 23 May and 24 May 2022, respectively, and comprised of seven trial pits. The trial pits were excavated to depths between 1.8 m bgl and 3.3 m bgl. Chemical laboratory testing of soil and leachate samples was conducted following the GI. This included Soil and Leachate Suites, Asbestos screening, speciated PAH tests, Total Petroleum Hydrocarbon (TPH CWG) tests, Volatile Organic Compounds (VOC) tests, Semi-Volatile Organic Compounds (SVOC) tests and Phenols (Speciated). The AECOM Phase 2 Ground Investigation Report, based on these ground investigations, is included as Appendix 12.3 to this ES. The ground conditions encountered as part of the GI are summarised in paragraph 12.6.33 of this ES. The results of the contamination assessment are discussed in paragraphs 12.6.69 to 12.6.78 of this ES.

## Geology

- 12.6.29 Information regarding the geology of the site is available on the British Geological Survey (BGS) 1:50,000 Sheet 81 (and including parts of Sheets 82 and 90) (Patrington) (BGS, 1991), the BGS GeoIndex Mapping Application (BGS, 2022a), BGS GeoRecords Plus interactive map (BGS, 2022b) and the BGS Lexicon of Named Rock Units (BGS, 2022c; 2022d and 2022e).

12.6.30 The geology on landside areas (excluding Long Wood) of the IERRT project site is summarised in Table 12.6.

**Table 12.6. Geology**

Stratum		Expected Location	Description (BGS Lexicon)
Artificial	Made Ground	The BGS GeoIndex 1:50,000 Artificial Map indicates Made Ground underlies most of the site, apart from a small area to the north of Sub Plot 1 and the south-east corner of Sub Plot 3. Although some areas of the site are not mapped as Made Ground on the Artificial Ground BGS 1:50,000 map, it is anticipated that Made Ground will underlie the entire area of the site based on the historical and current development. There are also some small areas of infilled ground indicated on mapping. This is congruent with the development history of the site.	Variable composition.
Superficial	Tidal Flat Deposits - Clay and Silt	The majority of the site, apart from the bank of the Humber Estuary.	Tidal flat deposits consist of unconsolidated sediment, mainly mud and/ or sand. They may form the top surface of a deltaic deposit, which is normally a consolidated soft silty clay, with layers of sand, gravel and peat.
	Beach and Tidal Flat Deposits (Undifferentiated) - Clay, Silt and Sand	Along the bank of the Humber Estuary.	Composite of 'Beach deposits' and 'Tidal Flat Deposits'. Beach deposits comprise shingle, sand, silt and



Stratum		Expected Location	Description (BGS Lexicon)
			clay, which may be bedded or chaotic. Beach deposits may be in the form of dunes, sheets or banks. The Tidal Flat deposits are commonly silt and clay with sand and gravel layers, possible peat layers from the tidal zone.
	Devensian Till (Glacial Till)	Entire site, underlying the Beach and Tidal Flat deposits.	No description given. Likely comprising a mixture of clay, sand, gravel, and boulders.
Bedrock	Burnham Chalk Formation	The north-west arm of the site.	White, thinly bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams.
	Flamborough Chalk Formation – Chalk	The majority of the site, apart from the north-west arm of the site.	White, well-bedded, flint-free chalk with common marl seams (typically one per metre). Common stylolitic surfaces and pyrite nodules.

12.6.31 No geological faults have been identified at the site or within the immediate vicinity of the site.

12.6.32 There are eight historical boreholes located within the IERRT project site boundary noted in the BGS records. Of the eleven on site boreholes, data for one borehole is accessible and the remaining seven boreholes are indicated by BGS as being confidential as the records are privately owned. Data for the four boreholes in the vicinity and the on-site boreholes were reviewed to understand the geology within the site and surrounding area: TA21NW10, TA21SW339, TA21SW249, TA11NE264 and TA21NW5. Made Ground was identified between ground level and 0.3 m below ground level (bgl). Warp (artificially induced alluvium) is likely to be present at depths between 7 m bgl and 10 m bgl. Peat was also observed at depths between 7 m bgl and 11 m bgl, although the thickness was observed as between 0.31 m and 0.81 m. The deposits of Peat are underlain by Marl, Marl Clay and Clay with thicknesses between 9.45 m and 25.91 m Sand and Gravel was observed in some off-site boreholes between 20.73 m bgl and 24.08 m bgl. Chalk bedrock was encountered at depths between 22 m bgl

and 33 m bgl, however, the thickness of the bedrock is not known as the base was not encountered in any boreholes. In the off-site boreholes, the Chalk was described as Soft to Hard Chalk. Borehole TA21NW5, located 38 m south of the site, noted the presence of Boulder Clay between 10.61 m bgl and 25.91 m bgl with thicknesses between 4.16 m and 7.07 m. Black Gravel was also observed in this borehole between 21.75 m bgl and 25.91 m bgl. It should be noted that the descriptions provided on all the borehole logs were limited to the name of strata only. Groundwater strikes were not recorded on these boreholes.

### **Encountered geology**

- 12.6.33 In May 2022, AECOM and ABP completed a GI within the area of Sub Plot 1, Sub Plot 3 and Sub Plot 4. Made Ground was encountered between ground level and 3.2 m bgl, with thicknesses between 0.3 m and 3.2 m. The composition of Made Ground was mostly gravel with fine to coarse sand, although slightly sandy slightly gravelly clay was also encountered. Anthropogenic material within Made Ground comprised of bricks, stone, rebar, cables, pipes, plastic bags and sheeting and fibre glass sheets. Topsoil was encountered between ground level and 0.1 m bgl. Reworked natural deposits of clay between 0.3 m and 1.9 m thick were encountered to a maximum depth of 3 m bgl, although the base was not proven. Peat was encountered at 0.1 m thickness in four exploratory hole locations to a maximum depth of 3.3 m bgl, although the base was not proven. Silt was encountered in two exploratory hole locations to a maximum depth of 1.1 m bgl and comprised of soft to firm brown slightly gravelly sandy silt with fine to medium gravel. Interbeds of silt and clay were recorded in one exploratory hole location (TP1).
- 12.6.34 In 2020, GD Pickles Ltd completed a GI within the area of Sub Plot 1 and Sub Plot 3 (Appendix 12.2 to this ES). The intrusive GI recorded variable thicknesses of Made Ground, and the maximum depth was observed between 0.8 m bgl and 5.0 m bgl, although it was mostly between 1.5 m bgl and 3.0 m bgl. The composition of Made Ground was observed to be imported construction/ industrial waste, and perched groundwater was also observed within Made Ground. The waste in Sub Plot 1 was described as similar to industrial waste or potentially household waste. GD Pickles hypothesised that the construction waste may date to the 1950s and 1960s based on the content of the waste. The Groundsure Report (GS-8247704, 2021) indicated that an historical landfill located in the southern area of Sub Plot 3 has a last recorded input date of 31<sup>st</sup> December 1990, however, no information was provided on a potential landfill located within Sub Plot 1. Tidal Flat Deposits were observed to depths of 3.7 m bgl, and typically comprised of firm orange, brown sandy clays and soft clays and silts were observed to depths between 9 m bgl and 10.9 m bgl. Boulder Clay was observed from circa 10 m bgl and the depth was proven to 19.3 m bgl. Sand and Gravel, with a thin layer of blowing sands was encountered beneath the Boulder Clay and was proven to a depth of 22.5 m bgl. Weathered Chalk was proven to 28 m bgl, depth and Hard Chalk was only proven to 28.5 m bgl due to drilling resistance.

- 12.6.35 In 1980 Exploration Associates completed a GI for the British Transport Docks Board on the eastern jetty location to the north-west of the site. The following strata was encountered: Silt, Made Ground, Interbedded Clays, Gravel, Sand and Gravel. Made Ground comprising of slag, silt, sand, boulders and cobbles was observed with a thickness of 2 m in BH02 and 5 m in BH04. The thickness of Silt ranged between 0.5 m and 9.3 m, with a maximum depth of 20 m bgl. Clay was encountered between 19.2 m bgl and 40 m bgl, with thicknesses between 1.3 m and 7.3 m. The thickness of Gravel ranged between 0.9 m and 4.3 m, and the thickness of Sand was recorded as 3.4 m to 3.6 m. Sand and Gravel was observed between 1.4 m and 3.2 m thick, with depths up to of 32.5 m bgl recorded. Groundwater was not encountered during the intrusive investigation.
- 12.6.36 In 1967, Ground Explorations Ltd completed a GI of Immingham for the British Transport Docks Board in close proximity to the area of Sub Plot 1. The intrusive investigation encountered soft Alluvial deposits with Peat, Boulder Clay, Interglacial deposits (sandy Clays and Sand and Gravel) and Chalk. The Chalk was encountered at -84 ft (25.6 m) BOD and -91 ft (27.7 m) BOD.
- 12.6.37 In 1965, a GI was undertaken for the British Transport Docks Board at the Habrough Marsh site and the South Killingholme site. The superficial deposits generally comprised of the following sequence: alluvium (very soft to soft organic silty clay), laminated clay, boulder clay and sand and gravel. At the Habrough Marsh site, chalk was encountered between -76.5 ft (23.3 m) BOD and -122 ft (37.2 m) BOD. Three boreholes in the Habrough Marsh site did not encounter chalk bedrock. At the South Killingholme site, chalk was encountered between -66.7 ft (20.3 m) BOD and -77 ft (23.5 m) BOD. However, two boreholes drilled in the South Killingholme site did not encounter chalk bedrock
- 12.6.38 There are no records of mineral extraction or non-coal mining on the site. Although the Coal Mining Authority Interactive Map Viewer (The Coal Authority, 2022) indicates the site is within a Coal Mining Reporting Area, the site is not within a Development High Risk Area. Therefore, a separate Coal Mining Risk Assessment is not required. Consultation with the Coal Authority confirmed this information and reiterated that the Coal Authority does not need to be consulted further.

## Hydrogeology

- 12.6.39 A summary of the hydrogeology on site, including aquifer designations, groundwater vulnerability and SPZ is provided in Table 12.7.
- 12.6.40 There are no groundwater abstractions within the IERRT project site boundary. However, there are eight groundwater abstractions within a 1 km radius, of which two are listed as active and operated by ABP. These abstractions are located 63 m south-east and 130 m north-east from the site and are associated with raw water supply.

**Table 12.7. Summary of hydrogeology on site**

Strata	Relevant Feature	Aquifer Designation
<b>Tidal Flat Deposits and Glacial Till</b>	Superficial aquifer designation	Unproductive
	Groundwater vulnerability	Low
	SPZ	None
<b>Beach and Tidal Flat Deposits (undifferentiated)</b>	Superficial aquifer designation	Secondary Undifferentiated
	Groundwater vulnerability	Low
	SPZ	None
<b>Burnham Chalk Formation</b>	Bedrock aquifer designation	Principal
	Groundwater vulnerability	High
	SPZ	None
<b>Flamborough Chalk Formation</b>	Bedrock aquifer designation	Principal
	Groundwater vulnerability	High
	SPZ	SPZ 1, 2 & 3

- 12.6.41 The groundwater abstraction located 63 m south-east from the site is associated with a SPZ 1 (Inner Catchment). The south-east corner of the site is located within the SPZ 1, and a radial area surrounding this is designated as a SPZ 2 within the south-east of the site. The remaining areas of the site are designated as SPZ 3 (Total Catchment). This is likely to be associated with an abstraction within the Flamborough Chalk Formation, although there is no information to confirm this.
- 12.6.42 The BGS Chalk Aquifer System of Lincolnshire Research Report (RR/06/03) (Whitehead and Lawrence, 2006) indicates the site could be in an area with artesian aquifers.
- 12.6.43 The majority of the landside area of the site is located with a Nitrate Vulnerable Zone for the North Beck Drain. The Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency define a Nitrate Vulnerable Zone as “*areas designated as being at risk from agricultural nitrate pollution*” (DEFRA and the Environment Agency, 2018).
- 12.6.44 During the GD Pickles Ltd 2020 GI, two groundwater bodies were observed and are considered to be perched groundwater within the Made Ground and at the boundary of the Made Ground and Tidal Flat Deposits. BH04 observed groundwater at 3.6 m bgl. The report noted that sub artesian pressures build up underneath Tidal Flat Deposits and Boulder Clay.

## Hydrology

- 12.6.45 There are three unnamed surface watercourses to the east of the site boundary and the site is adjacent to the Humber Estuary. Within a 250 m radius from the site, there are a further 37 unnamed surface watercourses. The records for surface watercourses provide information on rivers,

streams, lakes and canals which are shown on the Water Network Ordnance Survey (OS) MasterMap. A summary of the Water Network OS MasterMap information is provided in the Groundsure Report (GS-8247704, 2021).

- 12.6.46 There are no surface water abstractions located on site, or within a 1 km radius from the site.
- 12.6.47 The Environment Agency Catchment Data Explorer (Environment Agency, 2022a) indicates the site is located within the North Beck Drain river body water catchment (ID: GB104029067575). The 2019 data for the water body indicates the overall status is 'moderate', the ecological status is 'moderate' and the chemical status is 'fail'. This is associated with Polybrominated Diphenyl Ethers (PBDE) and Mercury and its compounds. The Habrough Marsh drain, which forms part of the North Beck Drain catchment, is designated as an 'Ordinary Watercourse' and falls under the jurisdiction of the North East Lincolnshire Internal Drainage Board. The watercourse skirts the south-western and south-eastern perimeters of the port estate flowing from west to east along the southern site boundary and discharges partly to the Humber Estuary and partly to the Stallingborough North Beck through the Immingham Pumping Station. The North Beck Drain has been designated as a heavily modified water body (HMWB) due to the use for coastal protection, flood protection and navigation use.
- 12.6.48 The Environment Agency's flood map for planning (Environment Agency, 2022b) indicates that most of the site is within Flood Zone 3. These are areas assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year (Groundsure Report (GS-8247704), 2021). The western area of Sub Plot 4 and north-east corner of Sub Plot 3 are designated as Flood Zone 2. Flood Zone 2 is described as a 1 in 1000 (0.1%) chance of flooding each year (Groundsure® Report (GS-8247704), 2021). The north-east corner of Sub Plot 3, the western area of Sub Plot 4 and a small area in the centre of Sub Plot 4 are designated as Flood Zone 1. Flood Zone 1 is described as a less than 1 in 1000 (<0.1%) chance of flooding each year (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government, 2014). The flood zone does not take into account the presence of flood defences in the area.
- 12.6.49 Water quality and flood risk are discussed further in Chapter 11 Coastal Protection, Flood Defence and Drainage of this ES.

## Designated and non-designated geology sites

- 12.6.50 The Natural England Designated Sites View website indicates Humber Estuary is designated as a SSSI of 'mixed' interest which includes geological interest for the Late Pleistocene sediments at South Ferriby Cliff located near Barton-Upon-Humber (Natural England, 2004; 2021). The site

is not within a designated geological site (Regionally Important Geological and Geomorphological Site) (North East Lincolnshire Council, 2015).

## Agricultural land use classification

12.6.51 The Agricultural Land Use classification for the entire site is Grade Urban (Natural England, 2019).

## Site history

12.6.52 Historical mapping was assessed within the Phase 1 Desk Study (Appendix 12.1 to this ES) using historical OS maps dating from 1884 to 2021. The IERRT project site has been part of the wider Port of Immingham since 1912. Therefore, the descriptions of historical land use from 1912 onwards refer to land use for port operational purposes.

12.6.53 From 1884 to 1964, the southern and western areas of the site comprised the Grimsby District Electric Light Railway, with several railway lines and associated railway buildings located on the site. The railway lines extended into the study area in the north and south, with additional railway infrastructure such as engine sheds, stores and coal hoists located within a 250 m radius.

12.6.54 From 1964, the railway lines were noted as disused, and several pipelines were constructed through the site. The site has remained mostly unchanged to 2021.

12.6.55 The area 250 m around the site has been extensively developed from 1964 onwards. Between 1964 and 1971, several oil storage depots, chemical works, tanks, electric sub stations, a warehouse and a jetty were constructed in the northwest, west and east of the site. Another electric substation was constructed within 100 m south of the site in the early 1970s, as well as a wagon repair shed also located within 100 m south of the site. The surrounding area remained mostly unchanged from the mid-1970s to mid-1980s. Further unspecified works, as well as a gas valve compound, were constructed in the late 1980s. From the mid-1980s onwards, the surrounding area has remained unchanged, with the demolition of one of the works and a storage tank associated with an oil storage depot denoted on 2021 mapping.

## Unexploded ordnance (UXO) risk assessment

12.6.56 A SafeLane Detailed Unexploded Ordnance (UXO) Threat Assessment Desk Top Study (9048 RA) was obtained for the site which indicates the UXO risk to the site is Medium (SafeLane, 2021). The Medium risk is derived from potential sources of German air delivered UXO, British or Allied UXO and the potential for UXO to be obscured by tidal or marine sediment.

12.6.57 A Zetica UXO Desk Study and Risk Assessment was obtained for the site by ABP dated 29th July 2022 which indicates the overall UXO hazard to the site is considered Low (Zetica UXO, 2022). Zetica define Low as “*there is no positive evidence that UXO is present, but its occurrence cannot be totally discounted*”.

### Potentially contaminative land uses

12.6.58 There are no active landfills on the site, although there are historical landfills located on the site which contain inert, industrial, commercial and household waste. An historical landfill located within Sub Plot 3 contains inert and industrial waste. The first input date is recorded as 31<sup>st</sup> December 1986 and last input date is recorded as 31<sup>st</sup> December 1990. The border of an historical inert, industrial, commercial and household waste landfill encroaches on the western boundary of Sub Plot 4. The first input date is recorded as 31 December 1935 and the last input date is recorded as 1 December 1978. This is a potentially contaminative land use as the landfill may produce leachate and landfill gases such as carbon dioxide and methane. An active landfill site is operated by Integrated Waste Management Ltd 186 m south-east from the site boundary.

12.6.59 The Groundsure Report indicates that there are two waste transfer sites located within the site boundary. However, the quality of mapping included within the Groundsure Report is not clear and indicates the waste transfer sites encroach on the site boundary of the IERRT project. The two licensed waste sites that encroach on the site boundary are: Sandstop Recycling for inert and excavation waste and Immingham Dock Transfer Station for special waste transfer. A further five licensed waste sites are located between 50 m and 250 m from the site boundary, as well as the two licenced waste sites within the site. A historical waste site is located 173 m south-west from the site boundary.

12.6.60 The current land use on site is understood to include slag and pumice stockpiles, a 5,200-litre diesel tank and a gas oil tank of unknown size.

12.6.61 The site history indicates railways and cuttings were previously located on the site, and railway lines are still present immediately south of the site.

12.6.62 Oil storage depots and chemical works for fertiliser are located immediately west of the site boundary.

12.6.63 A sewage works is located immediately to the east of the Long Wood, and historical mapping indicates an unspecified works was located adjacent to the sewage works between 1964 and 1969.

12.6.64 Unspecified depots/ works and a warehouse are located on site, and there are several located within 50 m and 250 m, south and west from the site boundary.

12.6.65 Several electric sub stations are located within 10 m and 250 m east, south and west from the site boundary.

### Previous contamination assessments

12.6.66 As part of the GD Pickles Ltd 2020 investigation, chemical testing was undertaken on soil samples and the concentrations were compared to the Generic Assessment Criteria (GAC) for Commercial Land Use. The GAC was only exceeded in TP24 within the west corner of Sub Plot 1 for the following determinands: Benzo(a)anthracene (190 mg/kg), Benzo(b)fluoranthene (150 mg/kg), Benzo(a)pyrene (150 mg/kg) and Dibenz(a,h)anthracene (22 mg/kg).

12.6.67 A Conceptual Site Model (CSM) was prepared as part of the GD Pickles Ltd report which identified the following sources: land reclamation/ landfill, railway land, Made Ground and permanent ground gases associated with the Tidal Flat Deposits. It was also noted that sulphides and sulphates may be present due to the natural ground conditions. The potential pathways included direct contact with soils, dusts and leachate; vapour inhalation of contaminants; migration of ground gases into buildings and structures; groundwater and surface water migration and direct contact with construction materials. The receptors identified in the CSM included construction workers, end users of the port, construction materials, groundwater and surface water such as the Humber Estuary and site drainage.

12.6.68 The overall risks for the CSM ranged between moderate/ low and moderate.

### AECOM contamination assessment (Appendix 12.3 to this ES)

12.6.69 Geo-environmental data obtained as part of the 2022 GI and the GD Pickles GI undertaken in 2020 was used to inform a Tier 2 Human Health Risk Assessment, a Tier 2 Controlled Waters Risk Assessment and a Ground Gas Risk Assessment presented in the AECOM Phase 2 Ground Investigation Report (included as Appendix 12.3 of this ES).

12.6.70 The Tier 2 Human Health Risk Assessment was undertaken using fourteen Made Ground soil samples from the 2022 GI and the eleven Made Ground soil samples from the GD Pickles GI. The soil samples were screened against the GAC criteria for a Commercial / Industrial land-use with a Total Organic Carbon (TOC) of 1.45 – 3.48%. No exceedances of the GAC criteria were recorded in reworked natural deposits. Exceedances were recorded in soil samples within Made Ground, as summarised in Table 12.8. The majority of the exceedances were recorded in two exploratory hole locations (TP6 in the GI and TP24 in the GD Pickles GI). However, these are considered to present a low risk as they are the same or one order of magnitude above the GAC criteria.



**Table 12.8. Summary of determinands identifying exceedances above GAC in Made Ground**

Determinand	No. of samples Exceeding GAC / No. of samples Analysed	GAC (mg/kg)	Recorded Concentration Range (mg/kg)	Order of Magnitude above GAC criteria
Benzo(a)anthracene	2 / 29	170	<0.05 – 190	Same order of magnitude
Benzo(a)pyrene	3 / 29	35	<0.05 - 150	1 order of magnitude
Benzo(b)fluoranthene	3 / 29	44	<0.05 – 150	1 order of magnitude
Dibenzo(a,h)anthracene	2 / 29	3.6	<0.05 – 22	1 order of magnitude
4-Chloroaniline	1 / 15	11	<0.6 – 15.1	Same order of magnitude

12.6.71 Seventeen samples of reworked natural deposits from the 2022 GI and one sample of clay from the 2020 GD Pickles GI were analysed for a suite of contaminants. The results of the screening indicated that there were no exceedances against their corresponding GACs.

12.6.72 A total of 28 samples from the 2022 GI and 15 samples from the GD Pickles GI were tested for asbestos. Chrysotile was encountered in TP4 from the 2022 GI at 1.2 m bgl, with a quantification result of 0.002% weight/weight.

12.6.73 A Tier 2 Controlled Waters Risk Assessment was undertaken whereby the soil leachate samples from the 2022 GI and the GD Pickles GI were compared to the Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) for Freshwater. The AECOM specified tests utilised the Environment Agency preferred leachate to soil ratio of (2:1) and the GD Pickles GI used a 10:1 leachate to soil ratio. A summary of the leachate exceedances is provided in Table 12.9.

12.6.74 Exceedances of ammoniacal nitrogen were recorded in Made Ground and reworked natural deposits in the same exploratory hole locations (TP1, TP2 and TP6 of the 2022 GI). This may indicate there is a potential source in Made Ground and a pathway to reworked natural deposits, which may be associated with the nearby ammoniacal nitrogen storage observed during the site walkover. Similar exceedances of copper and nickel were observed in two exploratory hole locations (TP7 and TP2, respectively) which may further indicate a pathway to reworked natural deposits.

**Table 12.9. Summary of the Tier 2 Exceedances in Soil Leachate**

Determinand	Units	DWS	EQS Freshwater	No. of samples Exceeding DWS / No. of samples Analysed	No. of samples Exceeding EQS / No. of samples Analysed	Recorded Concentration Range	Order of Magnitude above DWS	Order of Magnitude above EQS Freshwater
<b>Made Ground</b>								
Arsenic*	mg/l	0.01	0.05	3 / 12	0 / 12	<0.001 – 0.0434	Same order of magnitude	-
Copper*	mg/l	2	0.001	0 / 12	4 / 12	<0.001 – 0.053	-	1 order of magnitude
Lead*	mg/l	0.01	0.0012	0 / 12	4 / 12	<0.001 – 0.008	-	Same order of magnitude
Nickel*	mg/l	0.02	0.004	0 / 12	5 / 12	<0.0003 – 0.0092	-	Same order of magnitude
Chromium* (Total)	mg/l	0.05	-	1 / 12	-	<0.001 – 0.138	1 order of magnitude	-
Zinc*	mg/l	6	0.0109	0 / 12	3 / 12	<0.002 – 0.019	-	Same order of magnitude
Ammoniacal Nitrogen	mg/l	-	0.3	-	4 / 7	<0.01 – 17.4	-	2 orders of magnitude
Chromium VI	mg/l	0.05	0.0034	1 / 12	3 / 12	<0.003 – 0.104	1 order of magnitude	2 orders of magnitude
Antimony*	mg/l	0.005	-	2 / 5	-	<0.0017 – 0.017	1 order of magnitude	-
Fluoride*	mg/l	1.5	1	4 / 5	5 / 5	1.3 – 7.6	Same order of magnitude	Same order of magnitude
Sulphate*	mg/l	250	400	3 / 5	3 / 5	180 – 1400	1 order of magnitude	1 order of magnitude

Determinand	Units	DWS	EQS Freshwater	No. of samples Exceeding DWS / No. of samples Analysed	No. of samples Exceeding EQS / No. of samples Analysed	Recorded Concentration Range	Order of Magnitude above DWS	Order of Magnitude above EQS Freshwater
<b>Reworked Natural Deposits (Clay, Clay with Peat and Silt)</b>								
Arsenic	mg/l	0.01	0.05	4 / 9	1 / 9	<0.001 – 0.052	Same order of magnitude	Same order of magnitude
Copper	mg/l	2	0.001	0 / 9	3 / 9	<0.001 – 0.002	-	Same order of magnitude
Lead	mg/l	0.01	0.0012	0 / 9	1 / 9	<0.001 – 0.002	-	Same order of magnitude
Nickel	mg/l	0.02	0.004	0 / 9	2 / 9	<0.001 – 0.007	-	Same order of magnitude
Zinc	mg/l	6	0.0109	0 / 9	1 / 9	0.002 – 0.013	-	Same order of magnitude
Boron	mg/l	1	2	2 / 9	0 / 9	0.05 – 1.24	Same order of magnitude	-
Iron	mg/l	0.2	1	2 / 9	1 / 9	<0.01 – 4.14	1 order of magnitude	Same order of magnitude
Ammoniacal Nitrogen	mg/l	-	0.3	0 / 9	5 / 9	0.2 – 9.9	-	1 order of magnitude
Chloride	mg/l	250	250	1 / 9	1 / 9	3 - 313	Same order of magnitude	Same order of magnitude
Chromium VI	mg/l	0.05	0.0034	0 / 9	1 / 9	<0.003 – 0.01	-	1 order of magnitude
Thiocyanate	mg/l	0.004	-	1 / 9	-	<0.2 – 0.82	2 orders of magnitude	-
Total Cyanide	mg/l	0.05	0.001	0 / 9	2 / 9	<0.02 – 0.02	-	1 order of magnitude
* Exceedances include a combination of results from the 2022 GI data and the 2020 GD Pickles GI data which have difference in leachate ratios								

- 12.6.75 The majority of exceedances are of the same, or one order of magnitude above the DWS and EQS Freshwater criteria. However, exceedances of ammoniacal nitrogen, thiocyanate and chromium (VI) were within two orders of magnitude above the DWS and EQS Freshwater criteria. The comparison of leachate chemical test results against generic assessment criteria for water is a conservative assessment of risk to groundwater. Therefore, groundwater monitoring, sampling and testing is ongoing as part of the confirmatory GI that has been commissioned.
- 12.6.76 A Ground Gas Risk Assessment was undertaken using the guidance in RB17: A Pragmatic Approach to Ground Gas Risk Assessment (CL:AIRE, 2012). The maximum TOC was recorded as 4.34% across the 2022 GI samples and the GD Pickles GI samples. Using the information provided in Table 1 of RB17, the site is characterised as Characteristic Situation CS3, which is defined as a *moderate* risk. However, it should be noted that a conservative approach was adopted as five samples recorded a Soil Organic Matter (SOM) content of >43% which were indicative results only and material with a high TOC was encountered in the GI. The results with a SOM of >43% were recorded within samples from Made Ground. The comparison of Total Organic Carbon chemical test results against generic assessment criteria for gas is a conservative assessment of risk to human health and infrastructure. Therefore, ground gas monitoring is currently ongoing as part of the confirmatory GI that was commissioned and is expected to be completed soon after the submission of the DCO application.
- 12.6.77 Following the Tier 2 Human Health and Controlled Waters Risk Assessments and the Ground Gas Risk Assessment, a revised conceptual site model and risk assessment was undertaken. The overall risks range between very low and moderate. The full revised conceptual site model, risk assessment and discussion of risks to receptors is provided in the AECOM Phase 2 Ground Investigation Report.
- 12.6.78 The risk to future site visitors is considered to be low to moderate. The risk to on-site workers within future buildings is considered to be low to moderate. The risk to on-site workers outdoors is very low to low. Offsite human health receptors are considered to be at a very low risk. The risk to surface waters is moderate/ low. The risks to Secondary Undifferentiated Aquifers are considered to be moderate/ low, and the risks to the Principal Aquifer are considered to be low to moderate/ low. Development infrastructure and construction workers are considered to be at a moderate/ low to moderate risk. The risk to flora and fauna is considered to be low.

## 12.7 Future baseline environment

- 12.7.1 The site of the IERRT project forms part of the operational Port of Immingham and has been in active use as a port since 1912. The site will continue to be utilised for port activity, irrespective of the development proposal for the IERRT project.

## 12.8 Consideration of likely impacts and effects

- 12.8.1 This section identifies the potential likely effects on the identified human health, geology and controlled water receptors as a result of the construction and subsequent operation of the IERRT project. Further detail is provided in Section 12.11 of this chapter whereby Table 12.11 of this chapter of the ES provides a summary of potential impacts, mitigation measures and residual impacts.
- 12.8.2 A GI has been undertaken which has been used to inform this ground conditions chapter of this ES.
- 12.8.3 A GI has been undertaken and a confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application. The GI and confirmatory GI were specified in accordance with the UK Specification for GI (Site Investigation Steering Group, 2012) and carried out in accordance with British Standard (BS) EN 1997-2:2007 Eurocode 7 (British Standards Institute (BSI), 2007), BS5930:2015+A1:2020 Code of practice for GIs (BSI, 2020) and BS10175:2011+A1:2017 Investigation of potentially contaminated sites. Code of Practice (BSI, 2017).
- 12.8.4 Assessment of potential contamination within this ES chapter is risk-based using the CSM and involving assessment of the contamination sources, receptors and plausible pollutant linkages at the site, in accordance with government guidance and the UK framework for the assessment of risk arising from contaminated land. The assessment takes into account principles adopted by the Environment Agency in Land Contamination: Risk Management (Environment Agency, 2021). The significance of impacts takes into account the principles of assessment identified in CIRIA Report C552, (CIRIA, 2001), NHBC/ CIEH/ Environment Agency (2008) Guidance for the Safe Development of Housing on Land Affected by Contamination (R&D66) and Environment Agency's guiding principles for land contamination in assessing risks to controlled waters (Environment Agency, 2010). The assessment is supported and informed by information from the 2022 GI.
- 12.8.5 Cumulative impacts on geology, controlled water and human health which could arise as a result of other developments and activities in the Humber Estuary is considered as part of the cumulative impacts and in-combination effects assessment. This is provided in Chapter 20 of this ES.

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## Summary of resource/ receptor value

12.8.6 This assessment considers the following resources/ receptors:

- Human health;
- An ecological system, or organism within such system, within a location that has been identified for protection under various European, national and local designations (including SPA, SAC, SSSI, NNR);
- Geology: Made Ground, superficial deposits and bedrock;
- Hydrogeological aquifer designations;
- Contamination to soils and groundwater;
- Property in the form of buildings and services; and
- Controlled Waters (surface waters including the Humber Estuary, North Beck Drain catchment and Habrough Marsh drain and groundwater).

12.8.7 A summary of the sensitivity/ value of the receptors at the site are presented in Table 12.10 of this chapter of the ES.

**Table 12.10. Resources Value (Sensitivity/Value)**

Aspect / Criteria	Resource / Receptor	Location	Sensitivity/ Value of Receptor	Justification
<b>Human Health</b>				
Human Health	Workers and site visitors	Onsite	Medium	The on-site workers and visitors will be the most at-risk human health receptors due to the proximity to their potentially contaminated soils/ vapours/ dust and groundwater. However, due to the site’s commercial/ industrial land use, human health is of a medium sensitivity.
Human Health	Workers and site visitors	Offsite	Medium	The wider Port of Immingham surrounding the IERRT project site is of a commercial/ industrial land use with offsite workers adjacent to the site being at particular risk to migrated vapour/ dust and groundwater. Due to the wider Immingham site’s commercial/ industrial land use, human health is of a medium sensitivity.
<b>Geology – Bedrock</b>				
Geology Bedrock	Burnham Chalk Formation	Northwest arm of the site	Negligible	No geological exposures, little/ no local interest. Bedrock is overlain by thick superficial deposits in most areas and Made Ground.
Geology Bedrock	Flamborough Chalk Formation	The majority of the site, apart from the north-west arm of the site.	Negligible	No geological exposures, little/ no local interest. Bedrock is overlain by thick superficial deposits in most areas and Made Ground.

Aspect / Criteria	Resource / Receptor	Location	Sensitivity/ Value of Receptor	Justification
<b>Geology – Superficial</b>				
Geology Superficial	Tidal Flat Deposits	The majority of the site, apart from the bank of the Humber Estuary.	Negligible	No geological exposures, little/ no local interest. These soils are overlain by Made Ground.
Geology Superficial	Beach and Tidal Flat Deposits (Undifferentiated)	Along the bank of the Humber Estuary.	Negligible	No geological exposures, little/ no local interest.
<b>Groundwater – Bedrock Aquifer</b>				
Groundwater (Bedrock)	Principal Aquifer - Burnham Chalk Formation	North-west arm of the site.	High	Principal Aquifer is of high sensitivity.  The aquifer is potentially of a lower sensitivity where it is overlain by a thick cover of low permeability unproductive superficial deposits. However, as the superficial deposits are described to contain sand and gravel layers the bedrock aquifer may still be susceptible.
Groundwater (Bedrock)	Principal Aquifer - Flamborough Chalk Formation	The majority of the site, apart from the north-west arm of the site	High	Principal Aquifer is of high sensitivity.  The aquifer is potentially of a lower sensitivity where it is overlain by a thick cover of low permeability unproductive superficial deposits. However, as the superficial deposits are described to contain sand and gravel layers the bedrock aquifer may still be susceptible.



Aspect / Criteria	Resource / Receptor	Location	Sensitivity/ Value of Receptor	Justification
<b>Groundwater – Superficial Aquifer</b>				
Groundwater (Superficial)	Secondary Undifferentiated – Beach and Tidal Flat Deposits	Along the bank of the Humber Estuary.	Low - Medium	Secondary undifferentiated productive aquifer combined with the underlying productive principal bedrock aquifer give a combined high sensitivity.
Groundwater (Superficial)	Unproductive – Tidal Flat Deposits	The majority of the site, apart from the bank of the Humber Estuary.	Low	Unproductive strata.
<b>Surface Waters</b>				
Controlled Waters	Humber Estuary	Partially on site	High	The Estuary is classified as an SAC, SPA, Ramsar site and SSSI.
Controlled Waters	North Beck Drain catchment	409 m south	High	The status of the North Beck Drain was classified as moderate by the Environment Agency in 2019 (Environment Agency 2022a), therefore the sensitivity is high.
Controlled Waters	Habrough Marsh Drain	Southern and eastern perimeters of the port estate.	High	The Habrough Marsh Drain is part of the North Beck Drain catchment which was given a moderate classification by the Environment Agency in 2019 (Environment Agency, 2022a).

Aspect / Criteria	Resource / Receptor	Location	Sensitivity/ Value of Receptor	Justification
<b>Property – Buildings and Services</b>				
Property	Buildings	Onsite in future	High	<p>Potential for degradation of foundations if the concrete specification does not account for aggressive ground conditions identified at the site.</p> <p>Potential for accumulation of ground gases. The site has been characterised as Characteristic Situation CS3 based on the TOC content of Made Ground, which suggests there may be a moderate ground gas risk.</p>
Property	Services	Onsite in future	Medium	Potential for degradation of service pipes if design does not account for aggressive ground conditions identified at the site.
<b>Ecological Systems</b>				
Ecological Systems	Humber Estuary	Partially on the site	High	The number of environment designations, including SAC, SPA, Ramsar site and SSSI suggests this is high sensitivity

## Construction phase

12.8.8 This section contains an assessment of the potential impacts to ground conditions including land quality receptors as a result of the construction (including demolition) phase of the IERRT project.

12.8.9 The following impact pathways have been assessed:

- Direct contact with contamination;
- Inhalation of dust and/ or soil derived vapours;
- Migration of ground gas; and
- Lateral and vertical migration (including as a result of piling) of contamination through leachate, groundwater or surface run-off.

12.8.10 With regard to existing geological and soils resources, construction has the potential to result in the following adverse impacts:

- Degradation of soil resources from the compaction of soil due to heavy construction vehicle movement, changes in topography, exacerbation of erosion through the handling and storage of soils, or ground stability impacts; and
- The generation of waste soils that cannot be reused elsewhere on the proposed development, requiring off-site disposal as waste.

12.8.11 Some potential exists for construction to result in beneficial impacts through the following:

- Removal or treatment of contaminated soil, with the effect that existing adverse effects on receptors are removed; and
- A reduction in soil erosion through improved drainage.

12.8.12 The construction of the whole IERRT project may be undertaken at the same time, or it may be sequenced such that construction of the southernmost pier and Western Storage Area takes place at the same time as operation of the northernmost pier (see Chapter 3 of this ES). In the case of a sequenced construction, the duration of construction activity will be extended but it will not increase the scale of construction activity. The capital dredging (and associated disposal activity) will be undertaken in a single stage in early to mid-2024 in the concurrent construction scenario. Construction is anticipated to begin early 2024 for both construction scenarios. This is not considered to affect the ground conditions assessment as these activities are not land based. Therefore, the impact pathway assessments are considered the worst case and will not be altered by the sequenced construction period.

### *Direct contact with contamination*

12.8.13 Site visitors and on-site workers are considered the main potential human health receptors likely to be affected by the construction phase (including

demolition) works. Potential adverse effects to human health are described in the following paragraphs.

- 12.8.14 Activities relating to foundation construction, earthworks and excavations and associated movement of ground materials have the potential to cause exposure of on-site workers and/ or site visitors and off-site workers and visitors to potentially contaminated dust. Asbestos in the form of chrysotile at 0.002% w/w was encountered during the 2022 GI in TP4. Exceedances of the human health GAC and the DWS and EQS Freshwater criteria were also recorded in the contamination assessment within Made Ground and reworked natural deposits. However, most exceedances were the same, or one order of magnitude above the criteria. leachate exceedances of chromium VI, ammoniacal nitrogen and thiocyanate were two orders of magnitude above the DWS and EQS Freshwater criteria. However, these risks will be mitigated by undertaking good practice as set out in CIRIA (2015) Environmental good practice on site guide (4<sup>th</sup> Ed) C741 and implementing a site-specific CEMP.
- 12.8.15 Disturbances and/ or removal of the ground materials and groundwater could potentially remove, relocate or mobilise existing potential contaminants (e.g., during foundation construction, earthworks and excavations) which could lead to impact of human health without appropriate controls.
- 12.8.16 Potential temporary impacts to human health may result from the accidental leak of fuels and oils from vehicular plant or from stored liquids. Other temporary impacts may also result from the use of materials and substances with polluting potential (e.g., concrete, fuel, oils and soil) which have the potential to be mobilised to ground or controlled waters. These risks will, however, be mitigated by the adoption of good practice as set in the guidance document CIRIA C741 and the implementation of the site-specific CEMP.
- 12.8.17 The sensitivity/ receptor value of human health receptors (onsite workers, site visitors and offsite workers) is considered to be medium. The magnitude of impact is considered to be moderate.
- 12.8.18 Therefore, in the absence of any mitigation the potential effect is considered to be **moderate adverse** (significant).

#### ***Inhalation of dust and/or soil derived vapours***

- 12.8.19 During construction, dust generation could affect human health receptors.
- 12.8.20 The sensitivity/ receptor value of human health receptors (onsite workers, site visitors and offsite workers) is considered to be medium. The magnitude of impact is considered to be moderate.

12.8.21 Therefore, the potential effect from inhalation of dust and/ or soil derived vapours without mitigation measures is considered to be **moderate adverse** (significant).

### ***Migration and accumulation of ground gas***

12.8.22 Ground gas may accumulate within temporary structures erected on site during construction. There is the potential for ground gas to be sourced from the Made Ground materials and organic rich soils around and underlying the site. Samples of Made Ground and reworked natural deposits recorded high SOM/ TOC content. As a result, the site has been classified as Characteristic Situation CS3, which is defined as a moderate ground gas risk. However, this is a conservative assessment of the ground gas risk. Ground gases also have the potential to accumulate within confined spaces. Entry into excavations or any other enclosed space on a construction site will comply with confined space legislation and be assessed prior to entry.

12.8.23 The receptors associated with the accumulation of ground gas are considered to be property (buildings) and human health.

12.8.24 The sensitivity/ value of the property receptor (building) is considered to be high. The magnitude of impact from migration and accumulation of ground gas is considered to be moderate. Therefore, in the absence of mitigation the potential effect is considered to be **moderate/ large adverse** (significant).

12.8.25 The sensitivity/ value of the human health receptors is considered to be medium. The magnitude of impact from migration and accumulation of ground gas is considered to be major. Therefore, in the absence of mitigation the potential effect is considered to be **moderate/ large adverse** (significant).

### ***Lateral and vertical migration of contamination (including as a result of piling) through leachate, groundwater or surface run-off***

12.8.26 Potential effects to controlled waters could arise from migration, caused by site works, of potential contaminants into the Principal Aquifers, Secondary Undifferentiated Aquifer or the Humber Estuary.

12.8.27 Excavations and foundations have the potential to disrupt shallow groundwater. Temporary groundwater controls such as dewatering or physical cut-offs may be required to prevent the excavations filling with water, which would likely result in the lowering of groundwater levels in the immediate area of the excavation. Shallow groundwater was encountered during the 2022 GI between 0.8 m bgl and 3.3 m bgl. TP4 was terminated at 1.8m bgl due to groundwater ingress. Service trenches can also provide preferential flow pathways for groundwater. Dewatering of excavations could result in an adverse risk to groundwater and could also draw contaminated groundwater on site, should any be present.

- 12.8.28 Accidental leaks of fuels and oils from vehicular plant equipment, stored liquids, and other polluting materials have the potential to be mobilised to groundwaters and surface water via vertical and lateral migration or surface run-off. These risks will be mitigated, however, by the adoption of good practice as set in the guidance document CIRIA C741 and the implementation of the site specific CEMP.
- 12.8.29 Disturbance and/ or removal of ground materials and groundwater could potentially remove, relocate or mobilise potential contaminants, e.g., during foundation construction, earthworks and excavations. Soil samples from Made Ground recorded exceedances of the human health GAC indicating potential sources of contamination within Made Ground. Exceedances were also identified in leachate samples from Made Ground and reworked natural strata, indicating further sources of contamination that could be mobilised during foundation works, earthworks and excavations. These exceedances are the same, or within one order of magnitude of the GAC, EQS Freshwater and DWS criteria and hence are considered to present a low risk. However, exceedances of chromium (VI), thiocyanate and ammoniacal nitrogen were two orders of magnitude above the DWS and EQS Freshwater criteria.
- 12.8.30 There is potential for creation of new Source-Pathway-Receptor linkages (e.g., pile foundation construction through existing Made Ground into underlying natural soils or bedrock) into an aquifer (comprised of coarse or sandy soils (superficial deposits) or chalk (bedrock)).
- 12.8.31 The creation of new potential contaminant linkages or mobilisation of existing contaminants may result from exposure of soils/ increases in rainwater infiltration through changes in ground cover/ in excavations or bulk earthworks. Leachate exceedances of ammoniacal nitrogen, copper and nickel were identified in Made Ground and reworked natural deposits within the same exploratory hole location, indicating a potential pathway from Made Ground to reworked natural deposits.
- 12.8.32 There is also potential for changes to the hydrogeological regime and potential mobilisation of contamination into groundwater during construction and potential effects on groundwater aquifers, e.g., from temporary dewatering activity required as part of construction.
- 12.8.33 The sensitivity/ value of the superficial and bedrock soils is considered to be negligible. The magnitude of impact as a result of piling is considered to be moderate. Therefore, in the absence of mitigation the potential effect without mitigation measures is considered to be **neutral/ slight adverse** (not significant).
- 12.8.34 The sensitivity/ value of the superficial aquifers (Tidal Flat Deposits/Beach and Tidal Flat Deposits) is considered to be low. The magnitude of impact from lateral and vertical migration of contamination through leachate, groundwater or surface run-off to the superficial aquifers is considered to be

moderate. Therefore, the potential effect without mitigation measures is considered to be **slight adverse** (not significant).

- 12.8.35 The sensitivity/ value of the bedrock aquifers (Burnham Chalk Formation/Flamborough Chalk Formation) is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through, leachate, groundwater or surface run-off to the bedrock aquifers is considered to be moderate. Therefore, the potential effect without mitigation measures is considered to be **moderate/ large adverse** (significant).
- 12.8.36 The sensitivity/value of the Humber Estuary is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through leachate, groundwater or surface run-off to the Humber Estuary is considered to be minor. Therefore, the potential effect without mitigation measures is considered to be **moderate adverse** (significant).
- 12.8.37 The sensitivity/ value of the North Beck Drain Catchment is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through groundwater or surface run-off to the North Beck Drain Catchment is considered to be moderate. Therefore, the potential effect without mitigation measures is considered to be **moderate/ large adverse** (significant).
- 12.8.38 The sensitivity/ value of the Habrough Marsh Drain is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through leachate, groundwater or surface run-off to the Habrough Marsh Drain is considered to be moderate. Therefore, the potential effect without mitigation measures is considered to be **moderate/ large adverse** (significant).
- 12.8.39 Mitigation measures for the construction phase are provided in paragraph 12.9.2 and are also summarised in Table 12.11 of this ES.

## Operational phase

- 12.8.40 This section contains an assessment of the potential impacts to geology, hydrogeology, development infrastructure and human health as a result of the operational phase of the IERRT project. The following impact pathways have been assessed:
- Direct contact with contamination;
  - Inhalation of dust and/ or soil derived vapours;
  - Migration and accumulation of ground gas; and
  - Lateral and vertical migration of contamination through groundwater and surface run-off.

### ***Direct Contact with Contamination and inhalation of dust and/ or soil derived vapours***

- 12.8.41 Direct contact or inhalation of contamination is unlikely as the site will be covered in hardstanding and the majority of human health receptors will be transient in nature. Receptors may change from the assumed baseline conditions and may include site workers, commercial users and visitors.
- 12.8.42 The sensitivity/ receptor value of human health receptors (future on site workers, offsite workers) is considered to be medium. The magnitude of impact is considered to be minor. Therefore, the potential effect from direct contact with contamination and inhalation of dust and/ or soil derived vapours is considered to be **slight adverse** (not significant).
- 12.8.43 Direct contact of aggressive ground conditions against property could overtime cause damage. The sensitivity of the property receptor is considered to be high. The magnitude of impact is considered to be moderate. Therefore, the potential effect without mitigation measures is **moderate/ large adverse** (significant).

### ***Migration and accumulation of ground gas***

- 12.8.44 There is the potential for ground gas migration and accumulation within structures built as part of the IERRT project. The Ground Gas Risk Assessment identified the site as a Characteristic Situation CS3 using the method outlined in RB17 (CL:AIRE, 2012), which is defined as a moderate risk from ground gas. A high SOM and TOC content was recorded within Made Ground and reworked natural deposits, which indicates potential for ground gas generation. It should be noted that this assessment has adopted a conservative approach. Ground gas monitoring (as part of the post GI works) is currently being undertaken following the completed confirmatory GI that has been commissioned for the purposes of informing detailed design. It is expected that the gas monitoring will be completed soon after the submission of the DCO application.
- 12.8.45 The sensitivity/ value of the property receptor (building) is considered to be high. The magnitude of impact is considered to be moderate. Therefore, the potential effect without mitigation measures is considered to be **moderate/ large adverse** (significant).

### ***Lateral and vertical migration of contamination through leachate, groundwater and surface run-off***

- 12.8.46 Impacts to soils, groundwater and surface water could potentially occur during operation as a result of accidental spills from the handling or leakage of fuels, lubricants, stored chemicals and process liquids. Standard industry practices will be adopted to mitigate these potential impacts.
- 12.8.47 The sensitivity/ value of the superficial and bedrock soils is considered to be negligible. The magnitude of impact from accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and process



chemicals is considered to be minor. Therefore, the potential effect is considered to be **neutral/ slight adverse** (not significant).

- 12.8.48 The sensitivity/ value of the superficial aquifers (Tidal Flat Deposits/Beach and Tidal Flat Deposits) is considered to be low. The magnitude of impact from lateral and vertical migration of contamination through groundwater or surface run-off to the superficial aquifers is considered to be negligible. Therefore, the potential effect is considered to be **neutral/ slight adverse** (not significant).
- 12.8.49 The sensitivity/ value of the bedrock aquifers (Burnham Chalk Formation/Flamborough Chalk Formation) is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through groundwater or surface run-off to the bedrock aquifers is considered to be negligible. Therefore, the potential effect is considered to be **slight adverse** (not significant).
- 12.8.50 The sensitivity/ value of the Humber Estuary is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through groundwater or surface run-off to the Humber Estuary is considered to be negligible. Therefore, the potential effect is considered to be **slight adverse** (not significant).
- 12.8.51 The sensitivity/ value of the North Beck Drain Catchment is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through groundwater or surface run-off to the North Beck Drain Catchment is considered to be negligible. Therefore, the potential effect is considered to be **slight adverse** (not significant).
- 12.8.52 The sensitivity/ value of the Habrough Marsh Drain is considered to be high. The magnitude of impact from lateral and vertical migration of contamination through groundwater or surface run-off to the Habrough Marsh Drain is considered to be negligible. Therefore, the potential effect is considered to be **slight adverse** (not significant).
- 12.8.53 Mitigation measures for the operational phase of the IERRT project are discussed in paragraphs 12.9.3 to 12.9.6 and are also summarised in Table 12.11 of this ES.

## 12.9 Mitigation measures

- 12.9.1 Where an effect without mitigation is determined to be significant (i.e., moderate or higher), mitigation measures are required. Mitigation measures are summarised in this section and presented in Table 12.11 of this chapter of the ES.

## Construction phase mitigation

12.9.2 Construction phase (including demolition) mitigation measures that will be implemented in relation to the geological and hydrogeological environment are as follows:

- The 2022 GI has been undertaken to provide site specific geo-environmental data to inform land contamination risk assessments and to assess ground conditions. A confirmatory GI has been undertaken with post GI monitoring works expected to be completed soon after the submission of the Development Consent Order (DCO) application;
- The DCO requires that the authorised development be undertaken in accordance with the CEMP. Therefore, construction works undertaken on site will be carried out in accordance the CEMP and environmental good practice on site;
- During the construction phase, entry into excavations or other enclosed spaces should comply with confined space legislation and be assessed prior to entry;
- As part of the DCO application an Outline Remediation Strategy has been prepared (Appendix 12.4 to this ES). The Outline Remediation Strategy sets out the measures required to mitigate any significant/unacceptable contamination risks. Where necessary, the strategy sets out requirements for disposal of materials that either do not meet the reuse criteria or are considered surplus to the scheme. The strategy also defines whether any treatment may be required, prior to reuse or disposal, as well as establishing risk-based compliance criteria for soils to be screened against. A final Remediation Strategy will be prepared to take account of any relevant matters arising during the examination of the IERRT DCO and any matters arising during the confirmatory GI and subsequent interpretative reporting;
- If, following the confirmatory GI undertaken for the purposes of detailed design, it is concluded that piling or other deep foundations or a form of ground improvement is to take place, the detailed construction methodology will be assessed to reduce the risk of the development of preferential pathways (e.g., groundwater flow) between the Made Ground present and the underlying Secondary superficial aquifers and Principal bedrock aquifers. The best practice guidance for piling (Environment Agency, 2001) and a foundation works risk assessment would be used in piling works plans and piling operations. Location specific Piling Risk Assessments should be undertaken and piling method statements should detail mitigation measures to protect the aquifer from potential pollution associated with piling operations;
- The confirmatory GI will define the site-specific position on aggressive ground conditions and derive concrete design sulphate (DS) and aggressive chemical environment for concrete classifications (ACEC).

The DS and ACEC classifications will be used to specify the appropriate class of any concrete foundation and/or service pipes that will be used in the construction of the IERRT project infrastructure. This will mitigate the potential risk caused by aggressive ground conditions.

- Ground gas protection measures will be implemented into building design to mitigate the risks associated with a CS3 site, albeit that this classification may be revised following any ground gas monitoring results provided by the complimentary GI. Appropriate mitigation measures will be implemented based on the Ground Gas Risk Assessment and in accordance with BS8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
- A Materials Management Plan (MMP), under CL:AIRE (2011) Definition of Waste: Development Industry Code of Practice, will be prepared and implemented to provide suitable controls to facilitate the re-use of materials such as soils and clean crushed concrete. The MMP will detail the procedures and measures to be taken to classify, track, store, dispose of and potentially re-use all excavated materials that are expected to be encountered during the development works;
- Dust generation will be kept to a minimum in accordance with general best practice, as outlined in, for example, “Environmental Good Practice on Site”, 3rd Edition, CIRIA Publication C692. The CEMP includes measures for the management of dust generation.
- All earthworks operations will be undertaken in accordance with BS1997:2004 Eurocode 7, BS16907-1 to 7:2018 Earthworks (BSI, 2018); BS6031:2009 Code of Practice for earthworks (BSI, 2009) and National Highways (NH) guidelines including DMRB Series 600 ‘Earthworks’ (Highways England, 2016). The IERRT project design will actively work towards achieving an earthworks balance. Best practice will be adopted during construction to prevent or minimise spillage risk and spillage impacts by adhering to the CEMP. The CEMP addresses the management of concrete batching, concrete usage and accidental spillage relating to foundation and building construction;
- Where soil materials are deemed to be surplus to the requirements of the project, such materials, will be classified as waste under the Waste Framework Directive (WFD) (2009/98/EC) as either hazardous (17-05-03) or non-hazardous (17-05-04) soils. Classification will be undertaken using a proprietary assessment tool such as “HazWasteOnline™”. Waste deemed to be hazardous, will require testing using the Waste Acceptance Criteria (WAC) prior to disposal to landfill. The ‘Waste Duty of Care Code of Practice’ (Department for Environment, Food and Rural Affairs, 2018) notes that there is a duty of care for the safe management of waste, particularly for the protection of the environment and human health. The duty of care is applicable if waste is imported, produced,

carried, kept, treated, disposed of or have control (as a dealer or broker) of waste. A Site Waste Management Plan forms part of the CEMP;

- Excavated material will be stockpiled in a designated area or areas of the site located away from watercourses to prevent run-off from the stockpile from entering surface water bodies;
- All areas of stockpiled soil may be reseeded or otherwise covered temporarily if they are not to be used within three months. All areas of unused and exposed soil following reinstatement of the proposed development will be reseeded or otherwise covered as soon as possible. Erosion protection matting may also be used to minimise sediment being entrained by water flow or becoming entrained by the wind if allowed to dry out;
- Washing out of vehicles or equipment will only take place in controlled areas;
- The design and build of temporary structures will incorporate ground gas protection measures as necessary;
- Utilities and services will be identified, removed and rerouted where necessary in locations of proposed structures. Haul routes will be created to remove and minimise the potential impact on utilities and services above or below ground; and
- Chapter 8 (Water and Sediment Quality) of the ES discusses specific guidance relating to the control of water pollution from construction sites.
- If, during development, any previously unidentified contamination is encountered, an appropriate investigation to allow sampling and testing of materials and risk assessment will be undertaken. Any actions resulting from the risk assessment will be agreed with the local planning authority along with any remedial measures in consultation with the Environment Agency, where risks to controlled waters are identified. An Outline Remediation Strategy, which includes steps to be taken if previously unidentified contamination is encountered during the construction stage, has been developed in parallel with the ES and the CEMP and will be submitted for DCO examination.
- The following risk mitigation measures are recommended by SafeLane to support the proposed works with regard to a medium UXO:  
Shallow intrusive works (e.g., excavations):
  - UXO Safety and Awareness Briefing (Toolbox Brief (TBB));
  - Site Specific Safety Instruction Training Courses;
  - Non-Intrusive Magnetometer Survey (in greenfield areas only) followed on by a target investigation;
  - Search and Clear; and

- Explosive Ordnance Disposal (EOD) Engineer Watching Brief for brownfield areas which are unsuitable for non-intrusive magnetometer survey.  
Deep intrusive works (e.g., piling)
  - UXO Safety and Awareness Briefing (TBB);
  - Site Specific Safety Instruction Training Courses; and
  - Intrusive magnetometer survey of pile/ borehole positions.
- The following risk mitigation measures are recommended by Zetica UXO to support the proposed works with regard to a low UXO risk:
  - For dredging activities, it is recommended that UXO awareness briefings are provided to dredging operations workers that includes a background to potential UXO hazards, awareness of the UXO risk and knowledge of the actions to be taken if a suspect item is found. It is also recommended that a site-specific Emergency Response Plan is produced detailing procedures for a UXO find in agreement with the local port authority and other stakeholders. Zetica recommend that the information in the Emergency Response Plan should follow CIRIA C754 '*Assessment and Management of (UXO) Risk in the Marine Environment*' (CIRIA, 2016) and the Crown Estate Guidance document '*Dealing with Munitions in Marine Sediments*' (Crown Estate, 2010). The Zetica report also notes that an ECO Engineer can be present during dredging operations if additional clearance is required.
  - For excavation activities, Zetica recommend that works can proceed and a formal UXO awareness can be provided if additional comfort is required.
  - For boreholes and piling activities, it is recommended to proceed with the works.

## Operational phase mitigation

- 12.9.3 No additional mitigation measures are considered necessary during the operational stage as the risks identified previously will have been mitigated during the construction stage.
- 12.9.4 Operational impacts are considered to be unlikely, as the IERRT project will be operated in accordance and comply with relevant regulations and legislation. Operational impacts will be limited to accidental spillage of polluting materials from Heavy Goods Vehicle (HGV) vehicles and tugs, and during maintenance works.
- 12.9.5 Potential risks posed to maintenance workers will be mitigated through adherence to appropriate site and task specific health and safety documentation, required for legal compliance. Maintenance workers that are required to undertake excavations during the operational life of the IERRT project will be provided with sufficient information as to the nature of each sub-area at the site, upon which to base site and task specific risk assessments. Best practice procedures will be adhered to during the operation of the site which will include standard procedures on the port to

protect the environment in case of spillages from vehicles such as spill kits. Information on the drainage system for the IERRT project is provided in Chapter 11 Coast Protection, Flood Defence and Drainage of this ES and a Drainage Strategy is provided in Annex B to Appendix 11.1 in Volume 3 of ES (Application Document Reference number 8.4).

- 12.9.6 Potential risks posed to buildings and services will be mitigated by using pipe materials appropriate for any aggressive ground conditions. The design and build of structures will incorporate ground gas protection measures as necessary.

## 12.10 Limitations and assumptions

12.10.1 The assessment has been undertaken based on the following assumptions:

- The assessment undertaken during the ES has been based on the collation and evaluation of available information obtained from the Environment Agency, BGS and Groundsure Report;
- The assessment undertaken during the ES has also been based on data from the 2022 GI and GD Pickles 2020 GI;
- The information presented in this chapter is based on the information available at the time of writing the report;
- If, during development, any previously unidentified contamination is encountered, an appropriate investigation to allow sampling and testing of materials and risk assessment will be undertaken. Any actions resulting from the risk assessment will be agreed with the local planning authority along with any remedial measures in consultation with the Environment Agency, where risks to controlled waters are identified;
- The Outline Remediation Strategy sets out steps that would be undertaken where previously unidentified contamination is discovered. Any actions required will be agreed with the planning authority and Environment Agency.

## 12.11 Residual effects and conclusions

12.11.1 A summary of the impact pathways that have been assessed, the identified residual impacts and level of confidence is presented in Table 12.11 to this chapter of the ES. The majority of the effects (after mitigation measures are implemented) are shown to be neutral, neutral/ slight or slight (not significant).

12.11.2 Mitigation measures will be adopted during the construction phase (including demolition) as described in Section 12.10 above. Potential impacts arising from the construction phase (including demolition) would be expected to be localised and short term. Therefore, the magnitude of any impacts caused by the disturbance and mobilisation of any previously unidentified contamination is considered neutral to slight. There may also be a slight beneficial effect if any previously unidentified contamination is identified and remediated.

12.11.3 There is the potential for earthworks to mobilise ground contamination impacting human health and/ or create preferential pathways to groundwater. The implementation of appropriate mitigation measures will reduce the significance of these pathways.

**Table 12.11. Summary of potential impact, mitigation measures and residual impacts**

Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
<b>Construction Phase (including demolition)</b>					
<b>Human Health (Contamination)</b> • Onsite workers • Site visitors	Direct contact with contamination (e.g., in soils)	Moderate adverse (significant)	Construction works would be carried out in accordance with the CEMP and environmental good practice on site.	Slight adverse (not significant)	High
<b>Human Health (Contamination)</b> • Off-site workers • Site visitors	Inhalation of dust and/or soil derived vapours	Moderate adverse (significant)	Construction works would be carried out in accordance with the CEMP and environmental good practice on site.	Slight adverse (not significant)	High
<b>Human Health (Ground Gas)</b> • Onsite workers • Site visitors	Migration and accumulation of ground gas	Moderate/ large adverse (significant)	Entry into excavations or any other enclosed space on a construction site will comply with confined space legislation and be assessed prior to entry.	Slight adverse (not significant)	High
<b>Property</b> Temporary buildings erected on site during construction	Migration and accumulation of ground gas	Moderate/ large adverse (significant)	Ground gas protection measures will be implemented into design and build of temporary structures.	Neutral/ slight adverse (not significant)	High
<b>Geology</b> • Beach and Tidal Deposits (Undifferentiated)	Lateral and vertical migration (including as a result of piling) of contamination through leachate, groundwater or surface run off	Neutral/ slight adverse (not significant)	Construction works would be carried out in accordance with the CEMP. Location specific Piling Risk Assessments and environmental good practice on site.	Neutral (not significant)	High



Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
<ul style="list-style-type: none"> <li>• Tidal Flat Deposits</li> <li>• Burnham Chalk Formation</li> <li>• Flamborough Chalk Formation</li> </ul>					
<p><b>Soils</b></p> <ul style="list-style-type: none"> <li>• Beach and Tidal Deposits (Undifferentiated)</li> <li>• Tidal Flat deposits</li> </ul>	Lateral and vertical migration (including as a result of piling) of contamination through leachate, groundwater or surface run off	Neutral/ slight adverse (not significant)	A GI has been undertaken in May 2022 to confirm baseline conditions. A confirmatory GI – to inform the detailed design - is being undertaken and will be completed soon after submission of the DCO application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report. In the event that any geo-environmental risks are identified following receipt of the final factual report, which will include the results of the final round of monitoring, as well as the conclusion of the assessment then in accordance with guidance in LC:RM (Environment Agency, 2021), appropriate mitigation measures as necessary will be incorporated in the final remediation strategy for the project, the outline for which is provided as Appendix 12.4.	Neutral (not significant)	High

Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
			<p>All earthworks operations will be undertaken in accordance with BS6031:2009 'Code of Practice for Earthworks', BS16907-1 to 7:2018 Earthworks and HE guidelines including DMRB Series 600 'Earthworks'. Development will actively work towards achieving an earthworks balance.</p>		
<p><b>Groundwater (Superficial Contamination)</b></p> <ul style="list-style-type: none"> <li>• Beach and Tidal Deposits (Undifferentiated) Secondary Undifferentiated Aquifer</li> </ul>	<p>Lateral and vertical migration (including as a result of piling) of contamination through leachate, groundwater or surface run off</p>	<p>Slight adverse (not significant)</p>	<p>A GI has been undertaken in May 2022 to confirm baseline conditions. A confirmatory GI – to inform the detailed design – is being undertaken and will be completed soon after submission of the DCO application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.</p> <p>Piling works will be assessed in accordance with best practice guidance (Environment Agency, 2001). Piling operations would be subject to foundation works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be</p>	<p>Neutral/ slight adverse (not significant)</p>	<p>High</p>

Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
			<p>detailed in piling method statements.</p> <p>Construction works would be carried out in accordance with the CEMP.</p>		
<p><b>Groundwater (Bedrock Contamination)</b></p> <ul style="list-style-type: none"> <li>• Burnham Chalk Formation Principal Aquifer</li> <li>• Flamborough Chalk Formation Principal Aquifer</li> </ul>	<p>Lateral and vertical migration (including as a result of piling) of contamination through leachate, groundwater or surface run off</p>	<p>Moderate/ large adverse (significant)</p>	<p>A GI has been undertaken in May 2022 to confirm baseline conditions and a risk assessment has been undertaken based on the GI data. A confirmatory GI – to inform the detailed design – is being undertaken and will be completed soon after submission of the DCO application. The findings of the confirmatory GI will be assessed and detailed in an interpretative report. In the event that any geo-environmental risks are identified following receipt of the final factual report, which will include the results of the final round of monitoring, as well as the conclusion of the assessment then in accordance with guidance in LC:RM (Environment Agency, 2021), appropriate mitigation measures as necessary will be incorporated in the final remediation strategy for the</p>	<p>Neutral/ slight adverse (not significant)</p>	<p>High</p>

Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
			<p>project, the outline for which is provided as Appendix 12.4.</p> <p>Construction works would be carried out in accordance with the CEMP.</p> <p>Piling works would be planned in accordance with best practice guidance (Environment Agency, 2001). Piling operations would be subject to foundation works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements.</p>		
<p><b>Surface Water (Contamination)</b></p> <ul style="list-style-type: none"> <li>• Humber Estuary</li> </ul>	Lateral and vertical migration of contamination through leachate, groundwater or surface run off	Moderate adverse (significant)	Specific guidance relating to the control of water pollution from construction sites is discussed within Chapter 8 Water and Sediment Quality of this ES.	Neutral/ slight adverse (not significant)	High
<p><b>Surface Water (Contamination)</b></p> <ul style="list-style-type: none"> <li>• North Beck Drain Catchment and associated Habrough Marsh Drain</li> </ul>	Lateral and vertical migration (including as a result of piling) of contamination through leachate, groundwater or surface run off	Moderate/ large adverse (significant)	Specific guidance relating to the control of water pollution from construction sites is discussed within Chapter 8 Water and Sediment Quality of this ES.	Neutral/ slight adverse (not significant)	High

Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
<b>Operational Phase</b>					
<b>Human Health (Contamination)</b> <ul style="list-style-type: none"> <li>• Future on-site workers</li> </ul>	Direct contact with contamination and inhalation of dust and/ or soil derived vapours	Slight adverse (not significant)	Maintenance workers will be required to adopt safe working practices under relevant health and safety legislation. Therefore, the significant effects are unlikely to arise.	Neutral/ slight adverse (not significant)	High
<b>Human Health (Contamination)</b> <ul style="list-style-type: none"> <li>• Future site visitors</li> <li>• Off-site workers</li> </ul>	Direct contact with contamination and inhalation of dust and/ or soil derived vapours	Slight adverse (not significant)	No mitigation measures are required as operation of the development is not likely to cause significant effect on offsite receptors with regards to geology and soils.	Neutral/ slight adverse (not significant)	High
<b>Property Building and Services</b>	Direct contact with contamination in soil, leachate and groundwater	Moderate/ large adverse (significant)	Buildings and services risks will be mitigated by using pipe material appropriate for any aggressive ground conditions.	Neutral/ slight adverse (not significant)	High
<b>Property Building and Services</b>	Migration of ground gas	Moderate/ large adverse (significant)	Ground gas protection measures appropriate to the site conditions will be implemented into design and build of structures.	Neutral/ slight adverse (not significant)	High
<b>Soils (Contamination)</b>	Lateral and vertical migration of contamination through leachate, groundwater or surface run-off	Neutral/ slight adverse (not significant)	The IERRT project will be operated in accordance with existing environmental legislation, regulations and good practice.	Neutral/ slight adverse (not significant)	High

Receptor	Impact pathway	Effect	Mitigation measure	Residual Effect	Confidence
<b>Groundwater (Superficial Contamination)</b>	Lateral and vertical migration of contamination through groundwater and surface run-off	Neutral/ slight adverse (not significant)	The IERRT project will be operated in accordance with existing environmental legislation, regulations and good practice.	Neutral/ slight adverse (not significant)	High
<b>Groundwater (Bedrock Contamination)</b>	Lateral and vertical migration of contamination through groundwater and surface run-off	Slight adverse (not significant)	The IERRT project will be operated in accordance with existing environmental legislation, regulations and good practice.	Slight adverse (not significant)	High
<b>Controlled Waters (Contamination)</b>	Lateral and vertical migration of contamination through groundwater and surface run-off	Slight adverse (not significant)	The IERRT project will have a managed surface drainage system and operated in accordance with existing environmental legislation, regulations and good practice.	Slight adverse (not significant)	High

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## 12.13 Abbreviations/Acronyms

<b>Acronym</b>	<b>Definition</b>
ABP	Associated British Ports
ACEC	Aggressive Chemical Concrete Classifications
ACMs	Asbestos Containing Materials
AMP	Asbestos Management Plan
ASSI	Area of Special Scientific Interest
bgl	Below Ground Level
BGS	British Geological Society
BOD	Below Ordnance Survey
BS	British Standard
BSI	British Standards Institute
CCTV	Closed Circuit Television
CEMP	Construction Environmental Management Plan
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research and Information Association
CL:AIRE	Contaminated Land: Applications in Real Environments
CSM	Conceptual Site Model
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DWS	Drinking Water Standard
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EOC	Explosive Ordnance Clearance
EPA	Environmental Protection Act
EQS	Environmental Quality Standard
ES	Environmental Statement
EU	European Union
GAC	Generic Assessment Criteria
GCR	Geological Conservation Review
GI	Ground Investigation
GWDTE	Groundwater Dependant Terrestrial Ecosystems

<b>Acronym</b>	<b>Definition</b>
HGV	Heavy Goods Vehicle
HMWB	Heavily Modified Water Body
IBC	Intermediate Bulk Container
IERRT	Immingham Eastern Ro-Ro Terminal
LGS	Local Geological Site
LNR	Local Nature Reserve
MHCLG	Ministry for Housing Communities and Local Government
MMP	Materials Management Plan
MMO	Marine Management Organisation
MPS	Marine Policy Statement
NH	National Highways
NHBC	National House-Building Council
NPPF	National Planning Policy Framework
NPSfP	National Policy Statement for Ports
NNR	National Nature Reserve
NSIP	Nationally Significant Infrastructure Project
OS	Ordnance Survey
PBDE	Polybrominated Diphenyl Ethers
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPG	Planning Practice Guidance
RBMP	River Basin Management Plan
RIGS	Regionally Important Geological Site
SAC	Special Area of Conservation
SOM	Soil Organic Matter
SPA	Special Protection Area
SPZ	Source Protection Zone
SNCIs	Sites of Nature Conservation Importance
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compounds
TBB	Toolbox Brief
TOC	Total Organic Carbon
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UXO	Unexploded Ordnance
VOC	Volatile Organic Compounds

<b>Acronym</b>	<b>Definition</b>
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

## 12.14 Glossary

<b>Term</b>	<b>Definition</b>
Aquifer	An aquifer is a geological formation which can contain or transmit groundwater. The type of aquifer indicates how permeable it is, its capability to store/yield significant quantities of water and also whether its quality is suitable for potable water supply
Baseline conditions	Existing conditions and past trends associated with the environment in which a proposed activity may take place
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
Cumulative effects	Combined effects of multiple developments or the combined effect of individual impacts (e.g., where different project elements in different locations have a cumulative impact on a particular feature)
Dangerous substance	A substance which presents flammable, toxic or explosive hazards to people, or which is dangerous to the environment
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 present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations
Hazard	A substance, operation or piece of equipment which has the potential to cause harm to people or the environment
Made Ground	Disturbed soils which include man-made or artificial materials
Nitrate Vulnerable Zone	Areas designated as being at risk from agricultural nitrate pollution

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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
Special Area of Conservation	A designated area protecting one or more habitats or species listed in the Habitats Directive
Site of Special Scientific Interest	An area of land which is of special interest for its flora, fauna, geological, geomorphological or physiographical features
Tidal Flat Deposits	Soil deposits formed from mud flats in the intertidal zone
Topography	The arrangement of the natural and artificial physical features of an area
Unproductive Strata	Soil and/or rock layers with low permeability that have negligible significance for water supply or base flow for rivers

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