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10.0 GEOLOGY, HYDROGEOLOGY AND CONTAMINATED LAND

10.1 Introduction

10.1.1 This chapter of the Preliminary Environmental Information (PEI) Report identifies the potential impacts and effects on geology, hydrogeology and contaminated land as associated with the Proposed Development Site. Consideration has been given to geology: superficial soils and bedrock, geological and hydrogeological designations, soils and Agricultural Land Classification (ALC), land contamination and minerals.

10.1.2 This chapter presents a preliminary assessment of potential impacts and effects and outlines proposed design and other measures to help mitigate potential effects.

10.1.3 This chapter is supported by the following figures (PEI Report, Volume II):

- Figure 10-1: Artificial Geology;
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10.2 Legislation and Planning Policy Context

Legislative Background

10.2.1 This section sets out key aspects and implications of policy and guidance that are relevant to the assessment of likely impacts on geology, hydrogeology and contaminated land.

EU Legislation

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

10.2.2 The Water Framework Directive (WFD) (European Parliament and of the Council, 2000) came into force in 2000. Its primary objective 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 aiming to prevent the 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 development that has the potential to have an impact on any part of the water environment.

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

10.2.3 This Groundwater Daughter Directive (European Environment Agency, 2006) 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 (2000/60/EC).

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

10.2.4 This Environmental Liability Directive (European Parliament and of the Council, 2004) relates to the prevention and remedying of environmental damage. The Directive refers to environmental damage to habitats and protected species, water damage (chemical and ecological) and land damage caused by land contamination. In this instance, damage is defined as "*a measurable adverse change in a natural resource or measurable impairment of a natural resource service which may occur directly or indirectly*". It also establishes a framework based on the 'polluter pays' principle to prevent and remedy environmental damage. Operators are therefore liable to the cost of prevention measures and remediation strategies.

Dangerous Substances Directive (2006/11/EC) (2006)

10.2.5 This Dangerous Substances Directive (European Parliament and of the Council, 2006) 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.

UK Legislation

Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (1990)

10.2.6 Part 2A of the Environmental Protection Act 1990 (Department for Environment Food and Rural Affairs, 1990) provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment. Enforcing authorities are required to identify and deal with such land.

The Environment Act (1995)

10.2.7 The Environment Act (Environment Agency (EA), 1995) established the EA and the Scottish Environment Protection Agency corporate bodies. This makes provision with respect to contaminated land and abandoned mines. Further provisions are provided for National Parks, pollution controls, natural resource conservation and environment conservation/enhancement.

The Environment Act (2021)

10.2.8 The Environment Act (EA, 2021) makes provision with respect to water (surface and groundwater), waste and improvement of the environment. It provides a legal framework for environmental governance and for specific improvement of the environment, including measures on waste and resource efficiency, air quality and environmental recall, water, nature and biodiversity and nature conservation covenants.

The Water Act (2003)

10.2.9 The Act 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. This Act also considers controlled water pollution and coal mine water discharges and describes provisions for land drainage and flood defence. This was issued to amend the 1991 Water Resources Act (UK Parliament, 1991) and Water Industry Act (UK Parliament, 1991).

The Water Act (2014)

10.2.10 The aim of the Act was to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as droughts and floods. The Act describes provisions for the following: abstraction water 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)

10.2.11 The Act gives the EA 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 (as amended) (1999)

10.2.12 These Regulations empower the EA 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) and The Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations (2019)

10.2.13 The Regulations 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, abstractions of groundwaters, enforcement and offences, public registers and powers/functions of the regulator and authority.

The Environmental Damage (Prevention and Remediation) (England) Regulations (2015)

10.2.14 The Regulations describe the legal framework for the prevention of environmental damage and the requirements for the 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 (2012)

10.2.15 The Contaminated Land Regulations set out the processes of risk assessment and identification/evaluation of remediation options. This is an amendment of the 2006 Contaminated Land (England) Regulations (UK Parliament, 2006).

The Waste (England and Wales) (Amendment) Regulations 2014 (as amended)

10.2.16 The Regulations set out the measures required for the prevention of, production and management of waste. The Regulations describe the purpose of waste prevention

programmes with waste prevention measures and refers to monitoring by appropriate authorities using qualitative or quantitative benchmarks.

Planning Policy Context

National Planning Policy

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

10.2.17 The National Policy Statements (NPSs) for energy infrastructure set out the Government's policy for delivery of major energy infrastructure (UK Government, 2023). The Overarching NPS for Energy (EN-1) is of relevance to the geology, hydrogeology and contaminated land assessment.

10.2.18 Section 4.10 (Pollution Control and Other Environmental Regulatory Regimes) details that issues relating to discharges or emissions from a proposed project which may affect air quality, land quality and the marine environment, or which include noise and vibration may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes. Before consenting any potentially polluting developments it should be confirmed that:

- the relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework; and
- the effects of existing sources of pollution in and around the site are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits.

10.2.19 Other relevant Sections include Section 5.3 Biodiversity and Geological Conservation, and Section 5.15 Water Quality and Resources.

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

10.2.20 The NPS for gas supply infrastructure and gas and oil pipelines set out the Government's policies for delivering natural gas and oil products (UK Government, 2023) and is in conjunction with the Overarching Energy NPS (EN-1). This NPS is of relevance to the geology, hydrogeology and contaminated land assessment.

10.2.21 Section 2.2 (Climate change adaptation) details the policy context for mitigating climate change for nationally significant energy infrastructure. Climate change resilience measures should account for increased risk of flooding, effects of rising sea levels and storm surges, higher temperatures, increased risk of earth movement and subsidence and any other increased risks identified in the assessment within the ES.

10.2.22 Section 2.8 (Underground Natural Gas Storage) sets out the limitations of site selection of underground storage due to geology and aquifers. The applicant's assessment must give consideration to the long-term integrity of affected strata within the construction, operational and decommissioning phases. The section also identifies non-exhaustive impacts which result from gas storage and supply infrastructure such as gas emissions, water quality and disposal of brine.

10.2.23 Section 2.10 further details the effects on water environments and aquifers as a result of underground gas storage facilities and the increased demand on water supplies due to the volume of extractions required to leach salt caverns. The assessment should consider the effects to groundwater resources such as reduction in water availability for other abstractions, the effects to ecological receptors that are dependent upon groundwater as well as the impact of the mobilisation of salt and other pollutants. It is likely an abstraction license will be required.

10.2.24 Section 2.23 (Gas and Oil Pipelines Impacts: Soil and Geology) details the importance of understanding the underlying strata and ground conditions along the route of the pipeline. This includes consideration for proposals of horizontal directional drilling (HDD) and whether the geological conditions are suitable. Appropriate mitigation can be used to reduce adverse impacts in line with the principles and practices outlined in the Code of Practice for the Sustainable Management of Soils on Construction Sites.

10.2.25 Section 2.22 (Gas and Oil Pipelines Impacts: Water Quality and Resources) details the importance of understanding the water quality and resources and the effects that the surface clearance and excavation for pipelines can have on water courses, aquifers, water abstractions and discharge points, areas prone to flooding and ecological receptors. Impacts during construction should be avoided through route selection or mitigated and ground reinstated after construction. The section further details possible appropriate mitigation measures.

10.2.26 Paragraph 2.23.3 describes how “When considering any application where the pipeline goes under a designated area of geological or geomorphological interest, the applicant should submit details of alternative routes, which either bypass the designated area or reduce the length of pipeline through the designated area to the minimum possible, and the reasons why they were discounted".

National Policy Statement for Electricity Networks Infrastructure (EN-5) 2011)

10.2.27 The NPS for electricity networks infrastructure set out the Government’s policies for delivering natural gas and oil products (UK Government, 2023) and is in conjunction with the Overarching Energy NPS (EN-1). This NPS is of relevance to the geology, hydrogeology and contaminated land assessment.

10.2.28 Section 2.4 (Climate change adaptation and resilience) details the considerations for flooding (particularly of substations vital for the network), effects of adverse weather on overhead lines, effects of increased temperatures, earth movement or subsidence caused by flooding or drought and coastal erosion for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations, which should be considered within the ES.

10.2.29 Paragraph 2.8.9 details the disruptive effects of undergrounding on the environment, archaeological sites, sensitive habitats, soils and geology and damage heritage assets. Applications should take into account that the Government has not laid down general rules of when an overhead line should be considered unacceptable.

10.2.30 Section 1.20 (Electric and Magnetic Fields) details the risks of electric and magnetic fields (EMFs) to human health, possible mitigation measures and highlights that there

is no direct statutory provision in the planning system relating to protection from EMFs.

Draft National Planning Policy

Draft Overarching National Policy Statement (NPS) for Energy (EN-1) 2023)

10.2.31 The UK Government is currently reviewing and updating the NPS for Energy the Draft Overarching NPS for Energy (EN-1) is of relevance to the geology, hydrogeology and contaminated land assessment.

10.2.32 Section 4.11 (Pollution control and other environmental regulatory regimes) (Department for Energy and Climate Change, 2011) includes the details as NPS EN-1 but includes consideration for discharges or emissions and indirect or direct impacts to terrestrial, freshwater, onshore and offshore environments. The section also refers to pollution from industrial sources is controlled through the Environmental Permitting (England and Wales) Regulations 2016 (EPR) and it is a requirement for industrial facilities to have an environmental permit (EP). There is a requirement for larger industrial facilities undertaking specific types of activities to use Best Available Technology (BAT) to reduce emissions to air, water and land. Other relevant Sections include Section 5.4 Biodiversity and Geological Conservation, and Section 5.16 Water Quality and Resources.

10.2.33 In 2020 the Government launched a review of the energy NPSs. The Draft Overarching NPS for Energy (EN-1) was published in September 2021 by the former Department for Business, Energy and Industrial Strategy (BEIS) (BEIS, 2021), and updates the existing NPS EN-1. A further update was published in March 2023 by the Department for Energy Security & Net Zero. The 2023 Draft EN-1 repeats the requirements as detailed above in the current EN-1.

Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) 2023

10.2.34 The UK Government is currently reviewing and updating the NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). This NPS is of relevance to the geology, hydrogeology and contaminated land assessment. The draft NPS is noted to refer to 'Natural Gas' rather than 'Gas' as within the current NPS EN-4.

10.2.35 Section 2.3 (Climate change adaptation) details the policy context for mitigating climate change for nationally significant energy infrastructure. The draft represents the requirements as the current NPS EN-4 detailed above.

10.2.36 Section 2.9 (Underground Natural Gas Storage: Applicant assessment) sets out the limitations of site selection of underground storage and considerations to geology and aquifers as detailed in the current NPS EN-4.

10.2.37 Section 2.21 (Natural Gas and Oil Pipelines: Applicant assessment) details the importance of understanding pipeline safety, impacts such as water quality and resources, and soils and geology and the potential impact that development might have on these. The section also highlights the effects of hydrostatic testing of pipelines which may take place during commissioning which may affect water quality and abstraction licenses and environmental permits are likely to be required.

Draft National Policy Statement for Electricity Networks Infrastructure (EN-5) 2023

10.2.38 The UK Government is currently reviewing and updating the NPS for Electricity Networks Infrastructure (EN-5). This NPS is of relevance to the geology, hydrogeology and contaminated land assessment.

10.2.39 Section 2.6 (Climate change adaptation and resilience) details the considerations for flooding as within the current NPS EN-5 but includes the addition of coastal erosion for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations, which should be considered within the ES.

10.2.40 Section 2.9 (Applicant assessment) details the impacts the applicant should consider; however, it notes that the list is not exhaustive and site-specific information should also be provided. This section also includes reference to the Horlock Rules, which provide guidance for the design and siting of substations and include consideration for environmental issues from the earliest stage to keep adverse effects to a reasonably practicable minimum. The guidance also refers to internationally and nationally designated areas of amenity, cultural or scientific value; the protection of local amenity value, existing habitats and landscape features including ancient woodland, historic hedgerows, surface and groundwater sources and nature conservation areas; and consider the land use effects.

10.2.41 Sections 2.13 and 2.14 (Electric and Magnetic Fields, and Sulphur Hexafluoride) detail the mitigation measures the applicant should consider to avoid and minimise the environmental impacts to both onshore and offshore at the early design stage in the development process. This includes considerations to electric and magnetic fields (EMFs) and sulphur hexafluoride on the environment.

National Planning Policy Framework (NPPF) (2021)

10.2.42 The NPPF sets out the government's planning policies for England and how these are expected to be applied. This Framework contains policies relevant to the geology and soils assessment. The 'Reforms to national planning policy' document has been put forward to the government by the Levelling Up, Housing and Communities Committee with recommendations to the government on the NPPF. This document is still within the consultation process and a response from the government is anticipated in September 2023.

10.2.43 Paragraph 120 c describes how "*Planning policies and decisions should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*".

10.2.44 Paragraph 170 details that planning policies and decisions for coastal areas should take account of the UK Marine Policy Statement and marine plans. This would include the North East Inshore Marine Plan to ensure effective alignment of the terrestrial and marine planning regimes.

10.2.45 Paragraph 173 describes the limits local planning authorities should place on the planned lifetime of a development in a Coastal Change Management Area. Temporary permissions and restoration conditions should be implemented where

necessary to reduce a potentially unacceptable level of risk to future people and the development.

10.2.46 Paragraph 174b relates to contributing to and enhancing the local environment through recognising the benefits of natural capital, ecosystem services, agricultural land, trees and woodland.

10.2.47 Paragraphs 183 – 188 form part of a section called 'Ground conditions and pollution'.

10.2.48 Paragraph 183 details requirements of planning policies in the context of proposed development on a site including adequate site investigation, suitability in the context of ground conditions, land instability and contamination and proposals for mitigation. This requires that land cannot be classified as contaminated post remediation as defined under the Environmental Protection Act 1990 Part IIA.

10.2.49 Paragraph 184 relates to the responsibility of developers and/or landowners for safe development.

10.2.50 Paragraph 185 refers to minimising the effects of pollution and adverse impacts from the proposed development.

Planning Practice Guidance (PPG) (2019)

10.2.51 The guidance was published to provide more in-depth guidance to the NPPF. The PPG of relevance to the geology and soils assessment is Land Affected by Contamination (MHCLG, 2019). The PPG aims to provide guiding principles on how planning can deal with land affected by contamination.

Local Planning Policy

Redcar and Cleveland Local Plan and Policies Map (2018)

10.2.52 The following policies and statements of the Redcar and Cleveland Borough Council (RCBC) Local Plan and Policies Map (RCBC, 2018) are relevant to the geology, hydrogeology and contaminated land assessment:

- Paragraph 1.70 – *"Redcar and Cleveland has substantial areas of contaminated land. The Local Plan will support the reclamation of contaminated land to enable the redevelopment of brownfield sites and help shift the perception of South Tees, presenting a cleaner, greener image of industry."*
- Policy SD 2 Locational Policy – *"Wherever possible, priority will be given to the development of brownfield land in sustainable locations, providing it is not of high environmental value, the reuse of existing buildings and limiting development in the countryside."*
- Paragraph 2.14 – *"In seeking to prioritise the re-use of previously developed land, the Council will continue to work with delivery partners including private developers, the Homes and Communities Agency and the Tees Valley Combined Authority which is, among other things, overseeing the preparation of a Brownfield and Surplus Public Sector Land Register, in line with government policy."*

- Paragraph 2.28 – *"Applicants proposing development on or near potentially contaminated land will be required to evidence that risks associated with contamination will be successfully addressed through remediation without undue environmental impact during and following the development in accordance with the Model Procedures for the Management of Land Contamination (CLR 11) [replaced by LC:RM (EA, 2021)], which have been developed to provide the technical framework for applying a risk management process when dealing with land affected by contamination."*
- Policy SD 7 Flood and Water Management – *"Discharge rates into surface water and combined sewers resulting from the redevelopment of brownfield sites will be limited to a maximum of 50% of flows consented for previous uses."*
- Paragraph 6.13 – *"To support these housing delivery aspirations, and in accordance with government policy a brownfield land register is currently being prepared by the Tees Valley Combined Authority in collaboration with the five local authorities."*
- Paragraph 6.26 – "*Prioritising where possible and including in terms of economic viability considerations, the development of previously developed ('brownfield') sites and other available land within existing settlement boundaries."*
- Policy N 4 Biodiversity and Geological Conservation – "*We will protect and enhance the borough's biodiversity and geological resources. Support will be given to high quality schemes that enhance nature conservation and management, preserve the character of the natural environment and maximise opportunities for biodiversity and geological conservation, particularly in or adjacent to, Biodiversity Opportunity Areas in the wider Tees Corridor, Teesmouth, East Cleveland and Middlesbrough Beck Valleys areas."*
  - *"…Priority will be given to protecting our internationally important sites, including the Teesmouth and Cleveland Coast Special Protection Area/Ramsar and European Marine Site, and the North York Moors Special Protection Area and Special Area of Conservation."*
  - *"…Development that is likely to have an adverse impact on nationally important SSSI sites, including broader impacts on the national network and combined effects with other development, will not normally be allowed. Where an adverse effect on the site's notified interest features is likely, an exception will only be made where: c. the benefits of the development, at this site, clearly outweigh both any adverse impact on the features of the site that makes it of special scientific interest, and any broader impacts on the network of SSSIs; d. no reasonable alternatives are available; and e. mitigation, or where necessary compensation, is provided for the impact."*
- Policy LS 4 South Tees Spatial Strategy – "The strategy includes:
  - Wilton International

  - South Tees Development Corporation area, as illustrated on the Policies Map (including current and former steelworks at South Tees and Redcar)
  - Teesport
  - South Tees Industrial Estates and Business Parks"
- The Strategy ensures the Council, and its partners will aim to consider the economy, connectivity and environment as the points detailed within the Strategy to secure decontamination and redevelopment of potentially contaminated land.

Redcar & Cleveland, South Tees Area Supplementary Planning Document (May 2018)

10.2.53 The following policies and statements of the Redcar & Cleveland South Tees Planning Area (STPA) Supplementary Planning Document (SPD, 2018) are relevant to the geology, hydrogeology and contaminated land assessment:

- Development Principle STDCI: Regeneration Principles
  - "To reduce pollution, contribute to sustainable flood risk management and habitat protection and encourage biodiversity and long term sustainability;
  - To support development which makes the best use of available land and existing infrastructure;
  - To support development that contributes to the creation of a healthy, active, safe and secure environment; and
  - To support the protection of heritage assets and the historic environment and the protection and enhancement of landscape character."
- Development Principle STDC3 – Phasing Strategy
  - Development that can be implemented in the early phases will be supported including areas which require ground remediation and site preparation.
  - "The redevelopment of areas requiring more extensive remediation, demolition and/or new or upgraded infrastructure will also be supported, although it is recognised that this is likely to take longer to secure. Development within the more contaminated areas should have regard to Development Principle STDC9 and the forthcoming Ground Remediation Strategy."
- Development Principle STDC7 – Natural Environmental Protection and Enhancement
  - "The Council will, in partnership with the STDC and investment partners and other key stakeholders, protect and, where appropriate, enhance designated and non-designated sites of biodiversity and geodiversity value and interest within the South Tees Area. The need to remediate known

contamination, including to reduce environmental harm, and to redevelop the South Tees Area for productive uses is fully recognised and supported by the Council. In doing so it will be important for all development proposals to be in accordance with the requirements of STDC7 and to respond to their environmental setting, in particular to protect and, where possible enhance, biodiversity and geodiversity interests.

- All proposals will be required to comply with Local Plan Policy N4 Biodiversity and Geological Conservation. Proposals with the potential to affect the Teesmouth and Cleveland Coast SPA should undergo a Habitat Regulations Assessment (HRA) with regard to the conservation objectives of the designation.
- The Council will support the delivery of a strategy for the regeneration area which promotes the provision of green infrastructure, in accordance with Local Plan Policy N2, including a series of connected open, private and public spaces, using open space as connectors not barriers to development.
- All proposals will be required to have regard to the forthcoming Environment and Biodiversity and Open Space Strategies and, where appropriate, the Redcar & Cleveland Teesmouth and Cleveland Coast SPA Recreation Management Plan, including in the mitigation of likely cumulative impacts on the natural environment. Net environmental gains should be provided where appropriate and viable, in accordance with Policies N2 and N4.

- Development Principle STDC9 – Site Remediation
  - "The Council supports the following approach to the remediation of land; Remediation will be proportionate, based on a risk assessment and respond to the development typology and its needs;
  - Where appropriate, remediation of the site will provide for environmental betterment;
  - The Ground Remediation Strategy will consider opportunities for the area of land identified as the Landfill Zone, subject to other regulatory requirements, to be used to support the remediation of STDC development land in the short term. Once the use of this area is no longer required it shall, itself, be the subject of a remediation scheme and may be made available for renewable energy or other appropriate development.
  - Development proposals should be in accordance with the forthcoming Ground Remediation Strategy and all remediation activities will be required to avoid adverse effects on the integrity, conservation objectives

or qualifying features of the Teesmouth and Cleveland Coast SPA and Ramsar site, in line with Policy N4 of the Local Plan.

- Development proposals and remediation activities will be required to avoid unacceptable impacts on water quality and contamination of the water environment.
- As the site incorporates large areas of previously developed land with a history of industrial uses there will be a requirement to remediate land in advance of development. The approach is one that will match the degree of remediation with end user requirements, to this end, the remediation of the South Tees Area will respond to investment needs and the release of land for development.
- It is recognised that areas of land will be subject to different levels of contamination and the approach of the STDC will be to assess the degree of contamination and to adopt a Ground Remediation Strategy in order to deal with that contamination based on site delivery and viability. Wherever possible and following an appraisal of remedial options, remediation of the site will provide a degree of environmental betterment of site conditions. The Ground Remediation Strategy, which is being prepared for the South Tees Area shall be the subject of a phasing plan which itself will balance the need to incentivise development to secure early investment in development opportunities.
- The area of land currently identified as the Landfill Zone (see Development Principle STDC14 - South Industrial Zone) is one which could be used to offset the costs of remediation of development sites once this site is no longer required, as utilising this area as a repository for residual, unsuitable materials from site preparation will save significant cost over offsite disposal. The site itself may be capped and remediated in accordance with the landscape strategy and is likely to be appropriate for future renewable energy development, or other forms of development, after it is capped. This approach will be considered in the site wide Ground Remediation Strategy.
- Development proposals located in proximity to former landfill sites should be supported by a Gas Risk Assessment and should incorporate any necessary protection measures, such as those to protect buildings from landfill gas migration."

Stockton-on-Tees Borough Council Local Plan (2019)

10.2.54 The following policies and statements of the Stockton-on-Tees Borough Council (STBC) Local Plan (STBC, 2019) are relevant to the geology, hydrogeology and contaminated land assessment:

- Natural Environment – Paragraph 8.45 – "*The planning system should contribute to and enhance the natural and local environment by:*
  - *protecting and enhancing valued landscapes, geodiversity and soils;*
  - *recognising the wider benefits of ecosystem services;*
  - *minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including the establishment of coherent ecological networks that are more resilient to current and future pressures;*
  - *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability; and*
  - *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."*
- Policy ENV5 Preserve, Protect and Enhance Ecological Networks, Biodiversity and Geodiversity – "*Development proposals should seek to achieve net gains in biodiversity wherever possible. It will be important for biodiversity and geodiversity to be considered at an early stage in the design process so that harm can be avoided and wherever possible enhancement achieved (this will be of particular importance in the redevelopment of previously developed land where areas of biodiversity should be retained and recreated alongside any remediation of any identified contamination). Detrimental impacts of development on biodiversity and geodiversity, whether individual or cumulative should be avoided."*
- Policy ENV7 Ground, Air, Water, Noise and Light Pollution – "*Where future users or occupiers of a development would be affected by contamination or stability issues, or where contamination may present a risk to the water environment, proposals must demonstrate via site investigation/assessment that:*
  - *a. Any issues will be satisfactorily addressed by appropriate mitigation measures to ensure that the site is suitable for the proposed use, and does not result in unacceptable risks which would adversely impact upon human health and the environment; and*
  - *b. Demonstrate that development will not cause the site or the surrounding environment to become contaminated and/or unstable.*
    - Groundwater and surface water quality will be improved in line with the requirements of the European WFD and its associated legislation and the Northumbria River Basin Management Plan. Development that would adversely affect the quality or quantity of surface or groundwater, flow of groundwater or ability to abstract water will not be permitted unless it can be demonstrated that no significant adverse

impact would occur, or mitigation can be put in place to minimise this impact within acceptable levels."

- Paragraph 8.73 – "*For development to be supported, such assessments will be required and demonstrate that pollution is or can, (through mitigation) be brought within acceptable levels. For the purposes of this policy 'levels' refers to statutory limits (such as those relating to air quality and contaminated land) and the wider consideration of impacts under the Environmental Protection Act (1990).*"
- Paragraph 8.75 – "*Stockton Borough has a legacy of previously developed land which can make an important contribution to its land supply for development. It is the responsibility of the developer and/or landowner to ensure development on site(s) affected by contamination or land stability issues result in a safe development.*"
- Paragraph 8.76 – "*Planning applications for new development on sites which are contaminated or are underlain by potentially unstable land must be accompanied by information which shows that investigations have been carried out to determine the nature and extent of any hazard, as well as the possible impact it is likely to have on future users and the environment. Any assessment should set out the detailed measures needed to allow the development to proceed safely, including, as appropriate those needed to improve and treat the land, address land stability and any other public safety issues. A Preliminary Risk Assessment should be submitted as a minimum which includes a desk study, conceptual model and initial assessment of risk; this information must satisfactorily demonstrate to the local planning authority that the risk to human health and controlled waters has been fully understood and can be addressed through appropriate measures. After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990. The aim is not to prevent development of the land but to ensure that new development is appropriate for its location and that the physical constraints on the land are taken into account at the planning application stage.*"

Hartlepool Local Plan (2018)

10.2.55 The following policies and statements of the Hartlepool Local Plan (HBC, 2018) are relevant to the geology, hydrogeology and contaminated land assessment:

- CC3: "*Renewable and Low Carbon Energy Generation (excluding strategic wind turbines and large scale solar photovoltaic developments) - Where appropriate, developers will need to include a satisfactory scheme to restore the site to a quality of at least its original condition when the development has reached the end of its operational life, including addressing any resultant land contamination issues.*"
- Paragraph 9.45 – "*The presence of any contamination on the land must be investigated and any necessary remediation measures put in place.*"

- QP6: Technical Matters – *"Point 2) The presence of any contamination on the land must be investigated and any necessary remediation measures put in place."*
- Paragraph 10.36 – "*Aquifers are vulnerable to various forms of pollution. Proposed developments should therefore ensure that suitable pollution prevention measures are in place to protect the water supplies from pollution. In particular, any future development that requires piling, deep foundations or removal of soil and clay cover should be suitably managed so that they do not produce new pathways for contaminants to enter the underlying groundwater. In addition, creation of new pathways which would allow high groundwater to inundate land causing localised groundwater flooding should be prevented."*

10.2.56 NE1: Natural Environment – "*Point 10) In prioritising the re-development of brownfield land, areas that are important for biodiversity will be retained or recreated within the site, and remediation of contaminated land will be pursued"* and *"Point 11) The major/principal aquifers underlying Hartlepool along with watercourses and other surface and coastal waters will be protected from over abstraction and contamination from pollutants and saline intrusion resulting from development. Developments will be required to demonstrate that they do not impact on the major/principal aquifer underlying Hartlepool, along with watercourses and other surface and coastal waters and they can achieve access to a sustainable water supply prior to approval."*

10.3 Assessment Methodology and Significance Criteria

Study Area

10.3.1 The Study Area for this assessment is the area over which the potential direct and indirect effects of the Proposed Development Site are predicted to occur during the construction, operation (including maintenance as necessary) and decommissioning phases.

10.3.2 The direct effects on geology and hydrogeology are those that may arise during construction, operation (including maintenance) and decommissioning. Effects may occur simultaneously during the period when Phase 1 has been constructed and is operational and Phase 2 is under construction.

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

10.3.4 The Study Area for geology, hydrogeology and contaminated land is considered to be the entirety of the ground within the Proposed Development Site, along with a buffer extending 250 m around the Proposed Development Site to identify potential offsite sources of contamination to inform the baseline condition within and adjacent to the Proposed Development Site. For assessment of effects to controlled waters including designated sites, groundwater abstractions and groundwater source protection

zones, a buffer extending 1 km from the Proposed Development Site is considered appropriate.

10.3.5 These Study Areas are considered to be appropriate for the assessment of geology, hydrogeology and contaminated land in accordance with methodology set out in Design Manual for Roads and Bridges (DMRB) LA109 Geology and Soils (National Highways, 2019a). The Study Areas are also based on professional judgement by competent experts with relevant and appropriate experience of assessing land contamination and contamination dispersion.

Impact Assessment Methodology

10.3.6 The geology, hydrogeology and contaminated land assessment considers the following resources:

- geology: artificial ground, superficial deposits and bedrock;
- mineral Resources;
- aquifer designations;
- soils and ALC; and
- contamination of soils and groundwater.

10.3.7 A detailed assessment of potential Source-Pathway-Receptor linkages and a risk assessment have been used to develop the Conceptual Site Model (CSM) – details will be provided in the Environmental Statement (ES).

10.3.8 To facilitate the impact assessment process and ensure consistency in the terminology of effect significance, a standard assessment methodology has been applied. This methodology has been developed using a range of guidance, including DMRB LA109 (National Highways, 2019a). The methodology is discussed in Chapter 2: Assessment Methodology (PEI Report, Volume I).

10.3.9 The terminology for the receptor value (sensitivity), magnitude of potential impacts and significance of effect differs from the assessment criteria terminology in Chapter 2: Assessment Methodology (PEI Report, Volume I). This methodology is appropriate for assessing the likely significant effects of the Proposed Development on geology, hydrogeology and contaminated land because it follows the standard guidance in DMRB LA109 (National Highways, 2019a) and DMRB LA113 (National Highways, 2020a), DMRB LA 104 (National Highways, 2020b), Land Contamination: Risk Management (Environment Agency, 2023) and A New Perspective on Land and Soil in Environmental Impact Assessment (Institute of Environmental Management and Assessment, 2022).

10.3.10 The assessment of receptor value (sensitivity) for geology, soils and controlled waters follows the procedure described in Table 3.11 of the DMRB LA 109 (National Highways, 2019a). The assessment of receptor value (importance) for groundwater resources follows the procedure described in Table 3.70 of the DMRB LA 113, Road Drainage and the Water Environment (National Highways, 2020a).

10.3.11 The value (sensitivity or importance) of a resource, ranges from Very High to Negligible (or Low for groundwater) 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, human health and controlled waters are provided in Table 10-1.

10.3.12 The magnitude of potential impacts upon geology, soils, human health and controlled waters 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).

The magnitude of impact on a receptor (geology, soils, human health and controlled waters) ranges from Major to No Change, with additional magnitude descriptions of Minor Beneficial, Moderate Beneficial and Major Beneficial prescribed to groundwater receptors. The criteria for determining the magnitude of impact upon receptors are provided in Table 10-2.

Table 10-1: Sensitivity (Value) of Geology, Soil and Water Environment Attributes (Adapted from DMRB LA109 Table 3.11 (National Highways, 2019) and DMRB LA113 Table 3.70 (National Highways, 2020a) Therein)

RECEPTOR VALUE (SENSITIVITY) IMPORTANCE	CRITERIA	ASPECT	TYPICAL EXAMPLES
Very High	Very rare and of international importance with no potential for replacement. Geology meeting international designation citation criteria which is not designated as such.	Geology	UNESCO (United Nations Educational, Scientific and Cultural Organisation) World Heritage Sites, UNESCO, Global Geoparks, Sites of Special Scientific Interest (SSSIs) and Geological Conservation Review sites where citations indicate features of international importance.
	Soil directly supporting an ES designated site.	Soils	Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar Site, ALC Grades 1 and 2 (as defined in Table 10-7).
	Human Health: very high sensitivity land use.	Contamination	Residential or allotments.
	Nationally significant attributed of high importance.	Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation Ecology and Nature Conservation. Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTEs) or Source Protection Zone (SPZ) 1.

RECEPTOR VALUE (SENSITIVITY) IMPORTANCE	CRITERIA	ASPECT	TYPICAL EXAMPLES
High	Rare and of national importance with little potential for replacement. Geology meeting national designation citation criteria which is not designated as such.	Geology	Geological SSSIs and National Nature Reserves (NNRs).
	Soils directly supporting a UK designated site.	Soils	SSSIs. ALC Grade 3a.
	Human Health: high sensitivity land use.	Contamination	Public Open Space.
	Locally significant attribute of high importance.	Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE or SPZ2.
Medium	Of regional importance with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	Geology	Regionally Important Geological Sites (RIGS).
	Soils supporting non-statutory designated sites.	Soils	Local Nature Reserves (LNRs), Local Geological Sites (LGS), Sites of Nature Conservation Importance (SNCIs). ALC Grade 3b.
	Human Health: medium sensitivity land use.	Contamination	Commercial or industrial land.
	Of moderate quality and rarity.	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.

RECEPTOR VALUE (SENSITIVITY) IMPORTANCE	CRITERIA	ASPECT	TYPICAL EXAMPLES
Low	Of local importance/interest with potential for replacement.	Geology	Non designated geological exposures, former quarries / mining sites.
	Soils supporting non-designated notable or priority habitats.	Soils	ALC Grades 4 and 5.
	Low sensitivity land use.	Contamination	Highways and rail.
	Lower quality.	Groundwater	Unproductive Strata.
Negligible	No geological exposures, little/no local interest.	Geology	Significant depth of Made Ground.
	Soils: previously developed land formerly in 'hard uses' with little potential to return to agriculture.	Soils	Industrial land/soils not present.
	Human health: undeveloped surplus land, no sensitive land use proposed.	Contamination	Extensive areas of existing hard standing.
	Negligible is not applicable to Groundwater under Table 3.7 of LA 113.	Groundwater	N/A

Table 10-2: Magnitude of Impact of a Resource (Adapted from DMRB LA 109 Table 3.12 and Table E/2.1 (National Highways, 2019) Therein)

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
Major	Result in loss of resource/designation or quality of the resource.	Geology	Loss of geological feature/designation and/or quality and integrity, severe damage to key characteristics, features or elements.
		Soils	Physical removal or permanent sealing of soil resource or agricultural land.
	Human health: significant contamination identified. Contamination levels significantly exceed background levels and relevant 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	Contamination heavily restricts future use of land.
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	Groundwater	Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Calculated risk of pollution from spillages ≥2% annually (Spillage Assessment). Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater quality and runoff assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification.

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
			Loss or significant damage to major structures through subsidence or similar effects
Moderate	Results in partial loss of resource/designation or quality of the resource.	Geology	Partial loss of geological feature/designation, potentially adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
		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).
	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.	Contamination	Control/ remediation measures are required to reduce risks to human health/ make land suitable for intended use.
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Groundwater	Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250.

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
			Calculated risk of pollution from spillages ≥1% annually and <2% annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.
Minor	Results in minor measurable change in resource/designation.	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.
		Soils	Temporary 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).
	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.	Contamination	Best practice measures can be required to minimise risks to human health.

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
Minor Adverse	Results in some measurable change in attributes, quality or vulnerability.	Groundwater	Potential low risk of pollution to groundwater from routine runoff – risk score <150. Calculated risk of pollution from spillages ≥0.5% annually and<1% annually. Minor effects on an aquifer, GWDTEs, abstractions and structures.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use and integrity.	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.
		Soil	No discernible loss/reduction of soil function(s) that restrict current or approved future use.
	Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g., category 4 screening levels SP1010).	Contamination	No requirement for control measures to reduce risks to human health/ make land suitable for intended use.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use and integrity.	Groundwater	No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Groundwater (only)	Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
Moderate Beneficial	Results in moderate improvement of attribute quality.	Groundwater (only)	Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE.
Major Beneficial	Results in major improvement of attribute quality.	Groundwater (only)	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.
No Change	No temporary or permanent loss in resource of designation.	Geology	No temporary or permanent loss/disturbance of characteristics features or elements.
		Soils	No loss/reduction of soil function(s) that restrict current or approved future use.
	Human health: reported contaminant concentrations below background levels.	Contamination	No intervention required.
No Change	No loss or alteration of characteristics, features or elements.	Groundwater	No observable impact in either direction.

Significance Criteria

10.3.13 Once the value (significance) of each resource and the magnitude of the potential impact has been established, the significance (effect) matrix from Table 3.8.1 DMRB LA 104 (National Highways, 2020b) has been used to determine the effect significance reproduced in

10.3.14 Table 10-3. This takes into account the details of effect descriptions presented in Table 3.7 of DMRB LA 104 (National Highways, 2020b) which has been reproduced in Table 10-4.

Table 10-3: 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

Table 10-4: Significance (Effect) Categories 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.

SIGNIFICANCE CATEGORY	TYPICAL DESCRIPTION
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

10.3.15 Where relevant, effects have been classified before and after mitigation measures have been applied, although embedded measures are taken into account prior to the assessment of effects to avoid considering assessment scenarios that are unrealistic in practice. Effects remaining after mitigation are referred to as 'residual effects.'

Sources of Information/Data

10.3.16 Current baseline conditions have been determined by a desk-based review of available information, supplemented by a site walkover which was undertaken on 17th November 2022 and relevant interpretive reports of previous ground investigation works. The full desk-based review will be included as an Appendix in the ES to be submitted with the DCO application. The baseline characterisation is considered to be sufficient to inform this preliminary assessment.

10.3.17 Further confirmatory intrusive investigation will be undertaken to support the assessments and will also be used to inform the Proposed Development Site detailed design, the scope of which will be agreed with the relevant authorities prior to commencing works.

Consultation

10.3.18 An EIA Scoping Opinion was requested from the Planning Inspectorate (the Inspectorate) in April 2023. A response was received on 17th May 2023. A high-level summary of responses to the Scoping Opinion relevant to geology, hydrogeology and contaminated land are outlined in Table 10-5.

Table 10-5: Responses to Scoping Opinion Comments

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE'S COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
The Inspectorate	Scoping Opinion 17th May 2023	**Potential Effects:** In addition to the impact pathways described at paragraph 6.4.88 of the Scoping Report, the ES should include an assessment of effects arising from changes to groundwater flow, levels and quality during construction, operation and decommissioning, including from the presence of below ground pipelines, where likely significant effects could occur. The Inspectorate notes that paragraph 6.3.20 of the Scoping Report states that potential impacts to groundwater flow would be assessed as part of this aspect.	The ES will include an assessment of effects arising from changes in groundwater flow, levels and quality during construction, operation and decommissioning including from presence of below ground pipelines
The Inspectorate	Scoping Opinion 17th May 2023	**Drainage Strategy:** The Scoping Report refers to implementation and maintenance of operational drainage systems to control potential impacts from pollution to surface watercourses. The Applicant should provide a draft/outline version of the drainage strategy and demonstrate how this will be secured through the DCO or other legal mechanism. Potential construction phase impacts should also be addressed in a drainage strategy.	An outline drainage philosophy will be submitted with the ES, and referenced in the Geology, Hydrogeology and Contaminated Land ES Chapter. The drainage strategy and detailed drainage design will be secured by a Requirement in the DCO.
The Inspectorate	Scoping Opinion 17th May 2023	**Baseline Information:** The desk-based assessments and conceptual site model should be	A desk-based assessment for the Proposed Development Site is included herein, and a CSM

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE'S COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		submitted as part of the ES. In addition to Main Sites A and B, these documents should provide information about land within the connection corridors. The baseline information should be sufficient to enable an assessment of the likely significant effects arising from the construction and operation of the Proposed Development, including consideration of the range of construction methods proposed or on the basis of any assumed construction methods where they are not known at time of ES preparation. This should include ground investigation if deemed necessary to sufficiently understand the baseline environment.	has been prepared. Details of these will be included in the ES.
The Inspectorate	Scoping Opinion 17th May 2023	**Intrusive Investigation:** The ES should include a full description of any further intrusive investigation required and confirm how this is to be secured. Effort should be made to agree the scope with all relevant consultation bodies e.g. Hartlepool Council and Stockton-on-Tees Council where it relates to land within their administrative area.	Details of the confirmatory intrusive investigation will be included within the ES.
The Inspectorate	Scoping Opinion 17th May 2023	**Drinking Water Protected Areas:** The Applicant's attention is drawn to the EA's comments in Appendix 2 regarding groundwater bodies being	Drinking water protected areas will be included in the baseline information and assessment to be included in the ES.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE'S COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		designated as drinking water protected areas. The status of the groundwater bodies should be reflected in the baseline description and assessment of potential impacts in the ES.	
Redcar and Cleveland Borough Council	14th April 2023 Updates to Planning Application for R/2023/1079/SCP	**Environmental Protection (Contamination):** The Consultee notes that the scoping opinion report recommends that geology, hydrogeology and contaminated land topic is scoped into the future impact assessment. In order to minimise the environmental impact I would recommend that the principles of the councils full standard contaminated land condition are followed in any future environmental impact assessment.	The principles of the council's full standard contaminated land condition will be followed in any future environmental impact assessment.
Redcar and Cleveland Borough Council	14th April 2023 Updates to Planning Application for R/2023/1079/SCP	**Local Lead Flood Authority (LLFA):** The Consultee recommends that applications are based on the guidance within the Tees Valley Design Guide and the principal of LLFA conditions 1, 2 and 3. The guidance for the design of the drainage scheme includes a discharge point for the disposal of surface water (LLFA 1).	An Outline Drainage Stragey will be submitted with the ES, and referenced in the Geology, Hydrogeology and Contaminated Land ES Chapter. The final Drainage Strategy and detailed Drainage Design will be secured by a Requirement in the DCO. The Outline Drainage Strategy will also be assessed in the ES in the Surface Water, Flood Risk and Water Resources Chapter.
Redcar and Cleveland Borough Council	14th April 2023	**Natural England:** The Consultee notes that Natural England must be consulted on Environmental Statements. The Environmental	Natural England will be consulted through statutory consultation via this PEI Report. The ES will be prepared in accordance with the

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE'S COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
	Updates to Planning Application for R/2023/1079/SCP	Statement should include a description of the development, an assessment of alternatives and reasoning as to why the option has been chosen, a description of the aspects of the environment likely to be affected by the development, a description of the likely significant effects on the environment, a description of the measures envisaged to prevent, reduce and offset adverse effects on the environment, a non-technical summary of the information and an indication of the difficulties encountered by the applicant in compiling information.	responses received as part of the statutory consultation.

Use of the Rochdale Envelope

10.3.19 To ensure a robust assessment of the likely significant environmental effects of the Proposed Development Site, the EIA is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate in line with the Inspectorate's Advice Note 9 (The Planning Inspectorate, 2018). This involves assessing the maximum (or where relevant, minimum)/worst case parameters for the elements of the Proposed Development where flexibility needs to be retained (building dimensions or operational modes for example).

10.4 Baseline Conditions

10.4.1 The baseline conditions relevant to geology, hydrogeology and contaminated land includes a detailed desk-based assessment of geological and hydrogeological conditions across the Proposed Development Site, a CSM, and an initial assessment of potential risks to human health and controlled waters.

10.4.2 At the time of writing this report, scheme specific ground investigation (GI), laboratory testing, and contamination assessment was not available. The baseline assessment as presented herein will be further reviewed and presented in the ES. A ground investigation (GI) and interpretive report will be undertaken to confirm ground conditions and chemical status. The data will be used to undertake human health, controlled waters and ground gas risk assessments to inform detailed design of the Proposed Development Site.

Existing Baseline

Ecological Designations

10.4.3 Ecological designations within the Proposed Development Site are summarised in Table 10-6 and are shown on Figure 10-10.

Table 10-6: Ecological Designations

SITE/RELEVANT FEATURE	DESCRIPTION
Main Site	No ecological designations are located within the Main Site
CO_2 Export Corridor	No ecological designations are located within the CO_2 Export Corridor.
Natural Gas Connection Corridor	No ecological designations are located within the Natural Gas Connection Corridor.
Water Connection Corridor	No ecological designations are located within the Water Connection Corridor.
Electrical Connection Corridor	No ecological designations are located within the Electrical Connection Corridor.
Hydrogen Pipeline Corridor	Ramsar Site (majority of corridor north of River Tees):

SITE/RELEVANT FEATURE	DESCRIPTION
	Teesmouth And Cleveland Coast Reference: UK11068 Total Area (m^2): 12,537,569.88
	SSSI: Teesmouth And Cleveland Coast Reference: 1000263 Total Area (m^2): 29,770,346.88
	SPA (as Ramsar Site above): Teesmouth And Cleveland Coast Reference: UK9006061 Total Area (m^2): 12,515,083.54
Other Gases Connection Corridor	No areas of sensitive land use are located within Other Gases Connection Corridor.

Soils – Agricultural Land Classification

10.4.4 Information is provided on DEFRA's interactive MAGIC online map (Magic, 2023) for ALC in the form of Provisional ALC and Post 1988 ALC maps. The Provisional ALC data covers the entire Study Area, whereas the Post 1988 ALC data shows a localised area in greater detail. Figure 10-19 presents Provisional ALC data of the Proposed Development Site. ALC definitions (provided by Natural England) are presented in Table 10-7. ALC grades 1, 2 and 3a deemed to be Best and most Versatile agricultural soils and ALC information for each part of the Proposed Development Site is presented in Table 10-8.

Table 10-7: Agricultural Land Classification Definitions

AGRICULTURAL LAND CLASSIFICATION	AGRICULTURAL LAND CLASSIFICATION DEFINITION
Urban Land	Outside classification
Non-Agricultural Land	Outside classification
Grade 5 – Very Poor Quality	Land with very severe limitations that restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.
Grade 4 – Poor Quality	Land with severe limitations which significantly restrict the range of crops or level of yields. It is mainly suited to grass with occasional arable crops (for example cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties using the land. The grade also includes arable land that is very dry because of drought.

AGRICULTURAL LAND CLASSIFICATION	AGRICULTURAL LAND CLASSIFICATION DEFINITION
Subgrade 3b – Moderate Quality	Land capable of producing moderate yields of a narrow range of crops.
Subgrade 3a – Good Quality	Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of crop
Grade 3 – Good to Moderate Quality	Land with moderate limitations that affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in grades 1 and 2.
Grade 2 – Very Good Quality	Land with minor limitations that affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown. On some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops, such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than grade 1.
Grade 1 – Excellent Quality	Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of crops

Table 10-8: Agricultural Land Classification of each Part of the Proposed Development Site

PART OF THE PROPOSED DEVELOPMENT SITE	AGRICULTURAL LAND CLASSIFICATION
Main Site	Urban and Non-Agricultural – Entirety of Main Site.
CO_2 Export Corridor	Urban and Non-Agricultural – Entirety of the corridor.
Natural Gas Connection Corridor	Urban and Non-Agricultural – Entirety of the corridor.
Water Connection Corridor	Urban and Non-Agricultural – Majority of the corridor. Grade 2 – Adjacent to the end of the Urban Classification in the south-east along Mains Dyke.
Electrical Connection Corridor	Urban and Non-Agricultural – Entirety of the corridor.

PART OF THE PROPOSED DEVELOPMENT SITE	AGRICULTURAL LAND CLASSIFICATION
Hydrogen Pipeline Corridor, North of River Tees	Urban – Adjacent to the River Tees up to the start of Greatham Creek and then followed south. Including the far west of the Corridor from Cowpen Bewley Road, encompassing the CF Fertiliser Site and surrounding area. Urban also located north of Greatham Creek. Grade 5 – Adjacent to the end of the Urban Classification from the end of Greatham Creek and moving west to encompass, Swallow Fleet, Holme Fleet and Greatham Creek, and the surrounding land. Grade 4 – Adjacent to the Grade 5 Classification and encompassing Cowpen Bewley Wood and the A1185 Road. Grade 3 – In the area of Marsh House Farm and to the north of this. Grade 2 – Adjacent to the Urban Classification and encompasses Mains Dyke.
Hydrogen Pipeline Corridor, South of River Tees	Urban and Non-Agricultural – Entirety of the corridor.
Other Gases Connection Corridor	Urban and Non-Agricultural – Entirety of the corridor.

Geology

10.4.5 The geology beneath the Proposed Development Site is shown on British Geological Survey (BGS) 1:50,000 Sheet 33 Stockton (1987) and Sheet 34 Guisborough (1998). It is also shown on extracts of the BGS 1:50,000 Digital Geological Map of Great Britain that were obtained as part of the Groundsure Reports.

10.4.6 BGS 1:50,000 scale mapping reproduced from the BGS digital data is shown on Figures 10-1: Artificial Geology, 10-2: Superficial Geology and 10-3: Bedrock Geology (PEI Report, Volume II).

10.4.7 BGS 1:10,000 Sheet NZ52NE (Warrenby) does not show the full extent of the superficial geology at the site and the straight line shown on other maps is an artifact noting the historical extent of geological mapping undertaken by the BGS (NZ52NE (BGS, 2006)).

10.4.8 A summary of the geology of the Proposed Development Site is provided in Table 10-9.

Table 10-9: Artificial, Superficial and Bedrock Geology of the Proposed Development Site

PART OF THE PROPOSED DEVELOPMENT SITE	ARTIFICIAL GEOLOGY	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
Main Site	Present – entire area	Tidal Flat Deposits Glaciolacustrine Deposits Till, Devensian	Redcar Mudstone Formation) Penarth Group (Rhaetic) Mercia Mudstone Group
CO_2 Export Corridor	Present – entire area	Blown Sand Tidal Flat Deposits Glaciolacustrine Deposits	Redcar Mudstone Formation Penarth Group Mercia Mudstone Group
Natural Gas Connection Corridor	Present – entire area	Blown Sand Tidal Flat Deposits Glaciolacustrine Deposits	Redcar Mudstone Formation Penarth Group Mercia Mudstone Group
Water Connection Corridor	Present – north-western extent	Blown Sand Tidal Flat Deposits Glaciolacustrine Deposits Till, Devensian	Redcar Mudstone Formation Penarth Group Mercia Mudstone Group
Electrical Connection Corridor	Present – western extent	Blown Sand Tidal Flat Deposits Glaciolacustrine Deposits Till, Devensian	Redcar Mudstone Formation Penarth Group Mercia Mudstone Group
Hydrogen Pipeline Corridor	Present – central and western extent east of the River Tees and eastern extent and localised areas west of the River Tees	Blown Sand Tidal Flat Deposits Glaciolacustrine Deposits Till, Devensian	Redcar Mudstone Formation Penarth Group Mercia Mudstone Group Sherwood Sandstone Group

PART OF THE PROPOSED DEVELOPMENT SITE	ARTIFICIAL GEOLOGY	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
		Peat Alluvium	
Other Gases Connection Corridor	Present – entire area	Blown Sand Tidal Flat Deposits Glaciolacustrine Deposits	Redcar Mudstone Formation Penarth Group Mercia Mudstone Group

Geological Features and Minerals

10.4.9 There are no recorded Regionally Important Geological Sites (RIGS) or Locally Important Geological Sites within the Proposed Development Site.

10.4.10 RIGS within Redcar and Cleveland outside of the Proposed Development Site include:

- Coatham Rocks RIGS, located approximately 2 km north-east of the Proposed Development Site; and
- Redcar Rocks RIGS (also a SSSI) located approximately 3.1 km north-east of the Proposed Development Site.

10.4.11 There are no recorded RIGS within Stockton-on-Tees.

10.4.12 RIGS within Hartlepool outside of the Proposed Development Site include:

- Hartlepool Headland Local Geological Site (LGS), located approximately 6.5 km north of the Proposed Development Site;
- Carr House Sands and West Harbour Long Scar and Little Scar LGS, located approximately 3 km north of the Proposed Development Site; and
- Dalton Batts River Claiff LGS, located approximately 5.7 km north of the Proposed Development Site.

10.4.13 The Tees Valley has a long history of mineral extraction, the specialist nature of which supported the development of the chemical and steel making industries on the Tees. However, the range of current primary mineral extraction is limited to crushed rock and sand and gravel with some brine extraction at Seal Sands and small-scale clay extraction at Cowpen Bewley. The Tees Valley has relatively few remaining minerals operations.

10.4.14 In taking forward minerals development in the plan area, and particularly along the river corridor and the Tees Estuary, any proposals will need to demonstrate that there will be no adverse impact on the integrity of the Teesmouth and Cleveland Coast SPA and Ramsar Site.

10.4.15 There is one brinefield, for salt production, currently active in the Study Area which is near Seal Sands in Stockton-on-Tees. Two further brinefields in the Seal Sands area have existing planning permissions and two brinefield cavities at Wilton in Redcar and Cleveland have existing permission for extraction under an 'Instrument of Consent'. The Wilton cavities are presently used for gas storage rather than extraction. Information from the BGS indicates brine extraction has limited viability itself, but it is acknowledged that there may be future interest to create storage caverns for gas and other fluids. Anydrite was formerly mined.

10.4.16 Permission was granted in 2009 for the extraction of natural gas at Kirkleatham from a Permian limestone reservoir. Permission also exists for the extraction of anhydrite from a deep mine at Billingham (Stockton-on-Tees), although the mine has not been worked since 1971.

10.4.17 Ten dormant minerals sites were identified in the Tees Valley, one of which has had new conditions approved for minerals extraction (the anhydrite mine at Billingham).

Of the remaining nine it is now considered that seven of these sites are highly unlikely to ever resume extraction due to recent development, designations or proposed allocations for other uses. Land at the remaining sites at Low Middlesfield Farm and Eaglescliffe Brickworks (Stockton-on- Tees) may require new planning permissions to be approved before they could be reopened.

10.4.18 The sterilisation of minerals occurs when other non-minerals developments take place on, or close to, mineral deposits and render them incapable of being extracted. Minerals Policy Statement 1 states inter alia that minerals safeguarding areas should be identified in Development Plan Documents (DPDs) to avoid such sterilisation. Sand and gravel, limestone, potash, salt, gypsum/anhydrite and coal are widespread across the Tees Valley. Whilst the extraction of these resources may not be currently viable for reasons of price, geology, quality and previous extractive work, this situation may change, and they may be required at some point in the future. The spatial extent of these deep and shallow resources, excluding certain areas of constraint, are identified as safeguarding areas on the plans of the Tees Valley Joint Minerals and Waste Core Strategy DPD (Stockton-on-Tees, 2011b) in Appendix A and the appropriate areas will be shown on each of the individual planning authority's adopted proposals maps.

10.4.19 Appendix C of the Tees Valley Joint Minerals and Waste Core Strategy DPD (Stockton-on-Tees Borough Council, 2011b) indicates Safeguarded Minerals (deep, salt and gypsum) extending below the whole of the Proposed Development Site (including service corridors). The MSA for gypsum (anhydrite) covers the whole of the Tees Valley plan area.

10.4.20 Safeguarded marine dredged sand and gravel (shallow resources) are present locally at Tees Dock. These resources may extend below the footprint of the CO_2 Export Connection Corridor and the Natural Gas Connection Corridors. Tees Dock is also identified as a Safeguarded Wharf. Billingham Reach Industrial Estate is identified as a Safeguarded Wharf.

Hydrogeology

10.4.21 The following WFD Groundwater Bodies are present within the Proposed Development Site:

- Tees Sherwood Sandstone, Good chemical rating and Good quantitative rating (2019); and
- Tees Mercia Mudstone, Poor chemical rating and Good quantitative rating (2019).

10.4.22 Figures 10-12 and 10-13 present the designated superficial and bedrock aquifers within the Proposed Development Site.

10.4.23 Hydrogeological classifications for each area of the Proposed Development Site are summarised in Table 10-10.

10.4.24 It should be noted that the Tidal Flat Deposits are designated as two separate aquifers on the DEFRA Magic Maps, which are based on Environment Agency data. On the DEFRA mapping the two aquifers are split by an artificial line orientated north

to south crossing the Main Site, see Figure 10-12. Tidal Flat Deposits – Sand and Silt (BGS) are designated as Secondary A within the majority of the Main Site and to the east, whilst Tidal Flat Deposits – Sand, Silt and Clay (BGS) are designated Secondary Undifferentiated within the minority of the Main Site and to the west. With reference to paragraph 10.4.9, BGS 1:10,000 Sheet NZ52NE (Warrenby) does not show the full extent of the superficial geology at the Main Site and the artificial straight line shown on the mapping appears to be an artifact noting the extent of mapping undertaken by the BGS (NZ52NE (BGS, 2006)).

10.4.25 There are no Groundwater Dependent Terrestrial Ecosystems (GWDTEs) or Source Protection Zone (SPZs) (SPZ 1 to 3) within 1 km of the Proposed Development Site.

Table 10-10: Hydrogeology of the Proposed Development Site

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
Main Site		
Superficial Aquifer	• Secondary A • Unproductive • Secondary Undifferentiated	• Tidal Flat Deposits – Sand and Silt (eastern half of the Main Site) • Glaciolacustrine Deposits (silt) • Glaciolacustrine Deposits (clay) • Till and Tidal Flat Deposits – Sand, Silt and Clay (western half of the Main Site)
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/ Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-
CO_2 Export Corridor		
Superficial Aquifer	• Secondary A	• Tidal Flat Deposits – Sand and Silt • Blown Sand

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
	• Secondary A • Secondary Undifferentiated • Unproductive	• Glacial Till • Glaciolacustrine Deposits - clay
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/ Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-
Natural Gas Connection Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt • Blown Sand • Till • Glaciolacustrine Deposits - clay
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-
Water Connection Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt • Blown Sand • Till

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
		• Glaciolacustrine Deposits - clay
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	• High (Secondary Superficial) • Medium (Secondary Superficial) • Low (Secondary Superficial) • Medium (Secondary Bedrock) • Low (Secondary Bedrock)	-
Source Protection Zone	None within 1km	-
Electrical Connection Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt (north-eastern extent of the Corridor) • Blown Sand • Till and Tidal Flat Deposits – Sand, Silt and Clay (for north-western and southern extend of the Corridor) • Glaciolacustrine Deposits - clay
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	• High (Secondary Superficial)	-

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
	• Medium (Secondary Superficial) • Medium (Secondary Bedrock) • Low (Secondary Bedrock)	
Source Protection Zone	None within 1km	-
Hydrogen Pipeline Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt (north-eastern extent of the Corridor) • Blown Sand • Till and Tidal Flat Deposits – Sand, Silt and Clay (north-west and south-west extent of the Corridor) • Glaciolacustrine Deposits - clay
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	• High (Secondary Superficial) • Medium (Secondary Superficial) • Medium (Secondary Bedrock) • Low (Secondary Bedrock)	-
Source Protection Zone	None within 1 km	-

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
Oxygen and Nitrogen Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary A	• Tidal Flat Deposits – Sand and Silt (most of the Corridor) • Blown Sand • Tidal Flat Deposits – Sand, Silt and Clay (far western and southernmost extend)
Bedrock Aquifer	• Secondary B • Secondary Undifferentiated/B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-

Historical Development

10.4.26 The Main Site has been subject to extensive industrial development since before the date of earliest Ordnance Survey map (1854), with potential contaminative uses present to the current day.

10.4.27 Possible historical industrial contaminative uses within 250 m of the Proposed Development Site include: unspecified heaps, tramway sidings, unspecified tanks, refuse heaps, unspecified works, slag and tarmacadam works, railway sidings, unspecified commercial/industrial, sand pits, unspecified ground workings, iron and steel works, railways building, slag works, iron works, pumping stations, oxygen works, unspecified warehouses, corporation yards, unspecified pits, unspecified factories, chimneys, old clay pits, cuttings, brick works, electricity substations, salt works, power stations, engine sheds, a fire station, a mortuary, disused brine wells, an oil storage depot, a cemetery, a smithy, a bedding works, rifle ranges, telephone exchange, electricity switch house, gas handling station, tunnel, oil refinery, oil terminal, oil supply terminal, slag wool works, dock, transit shed and terminal.

10.4.28 A CSM has been prepared using a Source-Pathway-Receptor model to identify potential pathways by which sources of contamination may impact on identified receptors.

Environmental Risk Assessment

10.4.29 Based upon the CSM produced for the Proposed Development, an evaluation of the risks posed by the identified potential pollutant linkages at the Proposed Development Site has been prepared.

Geotechnical Risk Register

10.4.30 An Engineering Assessment and Geotechnical Risk Register will be provided in the ES.

Future Baseline

10.4.31 The future baseline conditions are expected to be the same as the existing baseline conditions described above. Future ground conditions may be improved relative to the existing baseline conditions, where existing soil resources are being treated/ remediated, prior to commencement of the Proposed Development Site.

10.5 Proposed Development Design and Impact Avoidance

10.5.1 The EIA process aims to avoid, prevent, reduce or offset potential environmental effects through design and/or management measures. These are measures that are inherent in the design and construction of the Proposed Development Site (known as 'embedded measures'). Some embedded measures are required as a result of legislative requirements and/or standard sectoral practices. Some of these embedded mitigation measures as applicable to the geology, hydrogeology and contaminated land assessment are described below.

10.5.2 Embedded measures are taken into account prior to the assessment of effects in order to avoid considering assessment scenarios that are unrealistic in practice i.e., effects do not take account of measures even though they are likely to be standard practice and/or form part of the design of the Proposed Development Site. These have then been followed through the assessment to ensure that realistic likely environmental effects are identified.

Proposed Development Design

10.5.3 The Proposed Development Site design will take into account existing ground conditions and the potential constraints that they pose. Prior to the design and construction of the Proposed Development on the Main Site, a GI will be undertaken which will include gathering data on the ground and groundwater conditions including testing for potential contaminants in the soil and groundwater, within the Main Site. The GI will also determine groundwater characteristics such as existing groundwater levels and flow regime, soil permeability, ground stratigraphy, chemical and environmental conditions and waste classification of soils. The GI will be specified in accordance with the UK Specification for Ground Investigation (Site Investigation Steering Group, 2012) and carried out in accordance with BS EN 1997-2:2007, BS5930:2015+A1:2020 and BS10175:2011+A2:2017.

10.5.4 The GI findings will inform the detailed design for the Proposed Development, such as, building and foundation design. In addition, existing pipeline infrastructure will be used where possible, running along existing pipe racking and using existing culverts and overbridges, to minimise impacts upon the ground and groundwater.

10.5.5 Information and findings from the ground investigation will also be used to confirm scope of remediation works on the Main Site required to mitigate risks to controlled waters and/or human health. At this stage, it is assumed that any remediation works required to create a suitable development platform would be undertaken by the landowner before the commencement of the construction of the Proposed Development on the Main Site, with the landowner obtaining all necessary consents and permits.

10.5.6 Remediation by the landowner will be subject to further review following assessment of ground condition information and permitting strategy. If a requirement for remedial measures to be undertaken during the construction phase of the Proposed development is identified, for example based on facility design, efficiency, or sustainability, the scope of those will be assessed by the Applicant. Therefore, the potential effects of site remediation have been considered in this assessment.

10.5.7 Estimates of waste from the Proposed Development Site in Chapter 21: Materials and Waste (PEI Report, Volume I), conservatively assume that some hazardous and non-hazardous material generated during the targeted remediation works before or during construction activities could require disposal from the Proposed Development Site, with re-use of some soil materials under appropriate permitting. The volume estimates will be further refined following supplementary site investigation.

Construction

10.5.8 A Framework Construction Environmental Management Plan (CEMP) will be included within the ES which will accompany the DCO Application which will set out the key measures to be employed during the Proposed Development Site construction phase to control and minimise the impacts on the environment. The CEMP will include measures associated with material management, land contamination and water resources.

10.5.9 A Final CEMP will be prepared by the construction contractor in accordance with the Framework CEMP prior to construction. The submission, approval, and implementation of the Final CEMP will be secured by a Requirement of the draft DCO.

10.5.10 In order to manage and monitor waste generated on the Main Site during Proposed Development Site construction, a Framework Site Waste Management Plan SWMP will be developed as part of the Framework CEMP which will allow for waste streams to be estimated and monitored and goals set with regards to the waste produced. The Framework SWMP will require that the construction contractor segregates waste streams on-site, prior to them being taken to a waste facility for recycling, disposal or reuse in accordance with appropriate permit. All waste removal from the Main Site will be undertaken by fully licensed waste carriers and taken to permitted waste facilities. In addition, the Final CEMP will also include a Materials Management Plan (MMP) following guidance in DoWCoP (CL:AIRE, 2011) and a Hazardous Materials Management Plan including an Asbestos Management Plan (AMP).

10.5.11 Construction phase mitigation measures in relation to the geological and hydrogeological environment are summarised here:

- Prior to the design and construction of the Proposed Development Site, a GI will be undertaken which will include taking geo-environmental samples of soils and groundwater across the proposed development site to assess for the potential for contamination and identify the potential impacts this may have to site users and the environment. The findings will feed into the CEMP to further define appropriate mitigation measures.
- Best practice will be adopted during construction to prevent or reduce as far as reasonably practicable spillage risk and spillage effects by adhering to the CEMP. The CEMP will address the management of concrete batching, concrete usage and accidental spillage relating to foundation and building construction.
- Should the GI Interpretive Report, foundation design strategy and remediation strategy prove the need for piling or soil mixing to take place, the construction methodology will be assessed, via a piling risk assessment, to reduce as far as reasonably practicable the risk of development of preferential pathways (e.g. groundwater flow) between the Made Ground present and the underlying Secondary 'A' or 'B' bedrock Aquifers. If piling is required, low noise piling techniques will be adopted where possible. The remediation strategy will be prepared if contaminant linkages are identified as part of the risk assessment undertaken as part of the GI Interpretive Report. The remediation strategy will be prepared either by the landowner or bp. The strategy will be in accordance with the requirements of the Land Contamination: Risk Management (Environment Agency, 2023) .
- The SWMP and MMP will be implemented to provide suitable controls to facilitate the re-use of materials such as soils and crushed concrete.
- An AMP will be required prior to the start of construction. Particular emphasis is placed on this with regards to the development of the Main Site.
- If any contamination is found during the construction of the Proposed Development, which has not been previously identified, an appropriate risk assessment will be prepared. Any actions/remedial measures resulting from the risk assessment will be agreed with the Local Planning Authorities (LPAs) and in consultation with the EA where risks to controlled waters are identified. The contamination assessment will be conducted in accordance with the CIRIA C552 - Contamination Land Risk Assessment, A Guide to Good Practice and the Land Contamination: Risk Management guidance (EA, 2021). Any required remedial measures will be adopted as part of the Proposed Development Site.
- The Proposed Development Site design is actively working towards a net cut and fill balance of zero. The suitability of excavated materials for potential re-use, and/or any permitting required to re-use excavated materials, will be assessed as part of the proposed GI works. All earthwork operations will need to be undertaken in accordance with BS6031:2009 (British Standards Institution, 2009) and applicable guidelines, including the Manual for Contract Documents for Highway Works (MCHW) Series 600 'Earthworks' (National Highways, 2017).

- Land disturbance will be reduced as far as is reasonably practicable and disturbed areas outside the development footprint will be revegetated as soon as possible after construction. Soil excavation will be undertaken with consideration given to the prevailing ground and weather conditions when programming the execution of the works to reduce the potential for mobilisation of exposed soil and/or sediment. Although not anticipated to be widely present across the majority of the Proposed Development Site, if encountered, topsoil and subsoil will be kept separately during excavation.
- Stockpiled excavation material will be kept to a minimum as far as is reasonably practicable and stored away from watercourses to prevent surface water entering or leaving the stockpile area.
- All areas of stockpiled material may be reseeded or otherwise covered temporarily until restoration activities commence. All areas of unused and exposed soil following reinstatement of the Proposed Development Site will be reseeded or otherwise covered as soon as possible. Erosion protection matting may also be used to reduce as far as is reasonably practicable sediment being entrained by water flow or becoming entrained by the wind if allowed to dry out.
- Temporary construction compound areas will be located away from all significant surface water bodies where possible. If the buffer zone has to be reduced, impermeable liners and bunds will need to be used to prevent materials entering watercourses.
- Washing out of vehicles or equipment will only take place in controlled areas.
- Suitable areas for specific construction activities will be identified within the CEMP and consultation with the EA will take place before construction commences.

10.5.12 Various fuels, oils and chemicals will be required during the construction of the Proposed Development Site. Measures to reduce potential effects associated with these substances during construction will include:

- The preparation of a map that highlights all potential contamination sources, which will be included as part of the CEMP, SWMP, MMP, and a Hazardous Materials Management Plan (including an AMP).
- The preparation of an inventory of all chemicals, fuels and oils will be kept up to date and be available on-site. Spill contingency plans will be created for each of the items on the inventory. These will be supported by warning notices and appropriate spillage containment equipment and materials at key locations.
- Chemicals, fuels and oils will be stored in secure and designated storage areas in accordance with the appropriate regulatory requirements, including the Control of Pollution (Oil Storage) (England) Regulations 2001 (UK Gov, 2001) and Control of Substance Hazardous to Health (COSHH) Regulations 2002 (UK Gov, 2002). Storage areas will need to be located on hardstanding areas to prevent the possible infiltration of contaminants into soils.

- Re-fuelling of plant will take place in appropriate areas to be agreed in the CEMP i.e. in locations with an impervious base and are bunded or provided with interceptor drains. Spill kits will be kept with all vehicles on-site and all bowsers are to be double skinned or have a bund. Vehicles and equipment will not be left unattended during re-fuelling. To prevent materials leaking from static plant, such as pumps and generators, static plant will be placed on drip trays wherever practicable.
- All pumps, generators and similarly fuelled equipment will be placed on drip trays or in a bunded area, and no vehicles or equipment will be allowed to enter any watercourses at any stage. Refuelling areas will be positioned a minimum of 50 m away from any watercourse or drain. All vehicles, generators and similarly fuelled equipment will be maintained to a high standard to reduce as far as is reasonably practicable potential pollution incidents.
- All valves, hoses and associated re-fuelling equipment will be regularly inspected to ensure that they are still in a suitable condition. This equipment will be protected from vandalism and unauthorised interference and will be turned off and securely locked when not in use.
- All storage of drums containing hazardous material will be located within the temporary construction compound. Any spillages or leaks will be dealt with promptly and all waste disposed of in an appropriate manner. All tanks, drums and other containers will be clearly marked as to their contents. Before any tank is removed or perforated, all contents and residues will be emptied by a competent operator for safe disposal.
- All bunds will have a capacity of at least 110% of the storage volume and will be covered where practical to prevent the collection of rainwater.
- Any staff involved in fuel handling will be given appropriate training, and site-specific procedures will be developed for all staff. Workers will be made aware of their statutory responsibility under Section 85 of the Water Resources Act 1991 (HMSO, 1991) not to 'cause or knowingly permit' water pollution. In addition, they will be made aware of their statutory responsibility under Regulations 38(1) and 12(1) of the Environment Permitting Regulations 2010 (HMSO, 2010) not to 'cause or knowingly permit' a water discharge activity or groundwater activity without an environmental permit.

10.5.13 Reference should also be made to the controlled water mitigation measures as detailed in Chapter 9: Surface Water, Flood Risk and Water Resource (PEI Report, Volume I).

Operation

10.5.14 The Production Facility will require an Environmental Permit and will comply with this under the Environmental Permitting (England and Wales) Regulations 2016.

10.5.15 Prevention of contamination is a specific requirement of the Environmental Permit for the operation of the Proposed Development Site. Therefore, it will be designed

so that it will not create any new areas of ground contamination or pathways to receptors as a result of both construction and operation.

10.5.16 The Proposed Development Site will be operated in line with appropriate standards, whilst the operator will implement and maintain an Environment Management System (EMS) which will be certified to International Standards Organisation (ISO) 14001. The EMS will outline requirements and procedures required to ensure that the Proposed Development Site is operating to the appropriate standard.

10.5.17 Mitigation measures proposed during the operation of the Proposed Development Site include:

- the implementation of standard industry practices to mitigate potential impacts from accidental spills or leaks;
- the storage and handling of processed chemicals will be undertaken in properly surfaced and bunded areas;
- implementation of rapid spill response planning and training; and
- the preparation of a groundwater quality monitoring plan.

Decommissioning

10.5.18 The Proposed Development Site has a long design life and as such it is not considered possible to reliably forecast decommissioning requirements and infrastructure far in the future.

10.5.19 The decommissioning phase is anticipated to involve the removal of all above surface structures. It is assumed that all underground infrastructure would remain in-situ; however, all connection and access points would be sealed or grouted to ensure disconnection.

10.5.20 Potential environmental effects during the decommissioning phase would be broadly similar to those during the construction phase, although there would be a need to address impacts from the production of bulk wastes from demolition of buildings and hardstanding to be recycled for re-use.

10.5.21 Decommissioning activities would be conducted in accordance with the appropriate guidance and legislation at the time of the Proposed Development Site's closure. It is anticipated that a large proportion of the materials resulting from the demolition would be recycled and a record kept to demonstrate that the maximum level of recycling and reuse has been achieved.

10.5.22 A Decommissioning Environmental Management Plan (DEMP) would be prepared which would consider in detail all potential environmental risks on the Proposed Development Site and contain guidance on how risks can be removed or mitigated.

10.5.23 The DEMP would be produced and agreed with the EA as part of the Environmental Permitting and site surrender process. The DEMP would consider in detail all potential environmental risks on the Proposed Development Site and contain guidance on how risks can be removed or mitigated. This would include details of

how surface water drainage should be managed on the Main Site during decommissioning and demolition.

10.5.24 Upon completion of the decommissioning programme, including any remediation works that might be required, the EA will be invited to witness a post-decommissioning inspection by site staff.

10.6 Likely Impacts and Effects

10.6.1 Table 10-11 summarises the resource value (sensitivity) of the identified receptors within the Proposed Development Site.

10.6.2 A summary of phased effects during Proposed Development Site construction, operation and decommissioning (taking into account the mitigation measures as detailed in Section 10.5) is provided in Table 10-12. Where significance of effects are considered to be not significant (inclusive of embedded mitigation), further mitigation is recommended in the form of ground investigation to confirm assessment.

10.6.3 Further discussion on the likely effects impacts and effects noted in Table 10-12 are discussed in the sections that follow the table.

Table 10-11: Resource Value (Sensitivity)

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
Geology – See Figure 10-3 – Bedrock Geology				
Geology Bedrock	Sherwood Sandstone Group – Sandstone	Hydrogen Pipeline Corridor	Medium	The Sherwood Sandstone is not a designated RIGS, geological unit, however considered medium due to aquifer designation described below.
Geology Bedrock	Mercia Mudstone Group – Mudstone	Entirety of the Proposed Development Site	Low	The Mercia Mudstone is a non-designated geological exposure.
Geology Bedrock	Penarth Group – Mudstone	Entirety of the Proposed Development Site	Low	The Penarth Group is a non-designated geological exposure.
Geology Bedrock	Redcar Mudstone Formation – Mudstone	Entirety of the Proposed Development Site	Low	The Redcar Mudstone is a non-designated geological exposure.
Geology Minerals	Concealed Permian Formations – Salt and Gypsum	Entirety of the Proposed Development Site	Medium	There is one brinefield reported in the Tees Value Minerals Core Strategy to be active near Seal Sands (Stockton-on-Tees), although the BGS have suggested this ceased operation in 2002. Two further brinefields in the Seal Sands area have existing planning permissions and two brinefield cavities at Wilton (Redcar and Cleveland) have existing permission for extraction under an 'Instrument of Consent'. Permission also exists for the extraction of anhydrite from a

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
				deep mine at Billingham (Stockton-on-Tees) although the mine has not been worked since 1971.
Soils – See Figure 10-19 – Agricultural Land				
Soils (ALC)	Agricultural Land Value (measured using the ALC)	Main Site CO_2 Export Corridor Natural Gas Connection Corridor Water Connection Corridor Electricity Connection Corridor Other Gases Connection Corridor	Low	Soils are recorded as non-agricultural/urban.
Soils (ALC)	Agricultural Land Value (measured using the ALC)	Hydrogen Pipeline Corridor	Grade 5 – Low Grade 4 – Low Grade 3 (Subgrade not defined) – High	Areas of ALC Grade 3 (3a (Moderate) or 3b (Good) not defined) north of River Tees. Areas of Grade 4 (Poor) and 5 (Very Poor) north of River Tees.
Soils – See Figure 10-1 – Artificial Geology and 10-2 – Superficial Geology				
Soils	Blown Sand	CO_2 Export Corridor (may be present)	High	Soils in sensitive environmental designations (Teesmouth and Cleveland Coast SPA, Ramsar Site and SSSI).

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
		Natural Gas Connection Corridor (may be present) Water Connection Corridor Electrical Connection Corridor Hydrogen Pipeline Corridor Other Gases Connection Corridor (may be present)		
Soils	Tidal Flat Deposits – Sand and Silt Tidal Flat Deposits – Sand, Silt and Clay Till, Devensian – Diamicton	Entirety of the Proposed Development Site	Low	Soils supporting non-designated notable or priority habitats. The majority of the Tidal Flat Deposits are exposed south west of the coastline and along the margins of the River Tees. Inland these soils are already overlain by Artificial Ground/Made Ground.
Soils	Glaciolacustrine Deposits, Clay and Silt Glaciolacustrine Deposits, Sand	Entirety of the Proposed Development Site	Low	Soils supporting non-designated notable or priority habitats.

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
	Glaciofluvial Deposits – Sand and Gravel Alluvium			
Groundwater – See Figure 10-13 – Bedrock Aquifers				
Groundwater Contamination (Bedrock)	**Principal Aquifer** Sherwood Sandstone Group – Sandstone	Entirety of the Proposed Development Site	High	Area is outside of any designated SPZ. The Principal Aquifer is of Low Vulnerability because at subcrop it is overlain by a thick cover of low permeability superficial deposits, and to the east of its subcrop it is overlain by low permeability mudrocks of the Mercia Mudstone Group and/or Penarth Group and/or Redcar Mudstone Formation.
Groundwater Contamination (Bedrock)	**Secondary Aquifer – B** Mercia Mudstone Formation - Mudstone	Entirety of the Proposed Development Site	Medium	Area is outside of any designated SPZ. Secondary Aquifer – B.
Groundwater Contamination (Bedrock)	**Secondary Aquifer – Undifferentiated** Penarth Group - Mudstone	Entirety of the Proposed Development Site	Medium	Area is outside of any designated SPZ. Secondary Aquifer – Undifferentiated/Secondary B.
Groundwater Contamination (Bedrock)	**Secondary Aquifer – Undifferentiated** Redcar Mudstone Formation - Mudstone	Entirety of the Proposed Development Site	Medium	Area is outside of any designated SPZ. Secondary Aquifer – Undifferentiated.

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
Groundwater – See Figure 10-12 Superficial Geology				
Groundwater Contamination (superficial)	**Secondary Aquifer - A** Blown Sand Tidal Flat Deposits – Sand and Silt	Main Site CO_2 Export Corridor Natural Gas Connection Corridor Water Connection Corridor Electrical Connection Corridor Hydrogen Connection Corridor	**High**	Area is outside of any designated SPZ. Secondary Aquifer – A.
Groundwater Contamination (superficial)	**Secondary Aquifer – Undifferentiated** Tidal Flat Deposits – Sand, Silt and Clay Till, Devensian – Diamicton	Entirety of the Proposed Development Site	**Medium**	Area is outside of any designated SPZ. Secondary Aquifer – Undifferentiated.
Groundwater Contamination (superficial)	**Unproductive Strata** Glaciolacustrine Deposits, Clay and Silt Glaciolacustrine Deposits – Sand	Entirety of the Proposed Development Site	**Low**	Area is outside of any designated SPZ. Unproductive Strata.

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
	Glaciofluvial Deposits – Sand and Gravel Alluvium			
Contamination (Soils)				
Contamination (Soils)	Blown Sand Tidal Flat Deposits – Sand and Silt Tidal Flat Deposits – Sand, Silt and Clay Till, Devensian – Diamicton Glaciolacustrine Deposits, Clay and Silt. Glaciofluvial Deposits, Sand and Gravel. Glacial Till, Devensian – Diamicton	Entirety of the Proposed Development Site	**Low**	Extensive existing Highways, Rail and Industrial Land Use. The majority of the Tidal Flat Deposits are exposed south west of the coastline or along the margins of the River Tees. Inland these soils are already overlain by Artificial Ground / Made Ground.

Table 10-12: Summary of Geology, Hydrogeology and Contaminated Land Effects

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Construction						
Geology Sherwood Sandstone Group – Sandstone Mercia Mudstone Group - Mudstone Penarth Group – Mudstone Redcar Mudstone Formation - Mudstone	Sherwood Sandstone Group – Sandstone: **Medium** Mercia Mudstone Group - Mudstone, Penarth Group – Mudstone and Redcar Mudstone Formation – Mudstone: **Low**	**Minor** (From Foundations)	Sherwood Sandstone Group – Sandstone: **Slight Adverse** (Not Significant) Mercia Mudstone Group - Mudstone, Penarth Group – Mudstone and Redcar Mudstone Formation – Mudstone: **Neutral or Slight Adverse** (Not Significant)	GI is required to confirm baseline assumptions and provide geotechnical parameters to inform foundation design including piling.	**Slight Adverse (Not Significant)**	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Geology Mercia Mudstone Group - Mudstone Penarth Group – Mudstone Redcar Mudstone Formation -	**Low**	**Minor** (From Directional drilling through mudstones to form crossing below the River Tees. Spoil generated from construction)	**Neutral or Slight Adverse** (Not Significant)	GI to confirm desk-based assumptions and to obtain specific geotechnical data/parameters to inform specification/design of drilling works. All earthworks operations will need to be undertaken in accordance with BS6031:2009 'Code of Practice for Earthworks' and applicable guidelines including MHCW Series 600 'Earthworks'. Mudstone / sandstone will not be reused across the Proposed Development Site due to geotechnical unsuitability (both) and high sulphate content (mudstone) which will erode / degrade	**Neutral or Slight Adverse (Not Significant)**	T

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
				reinforced concrete structures. Encountered mudstone / sandstone will be removed from the Proposed Development Site.		
Minerals Deep Resources Salt and Gypsum	**Medium**	**Minor** (from sterilisation of minerals. Non-minerals developments take place on, or close to, mineral deposits and render them incapable of being extracted. Development to take place across an area defined in the Tees Valley Joint Minerals and Waste Development Plan Core Strategy as protected to allow for future Gypsum and Salt extraction)	**Slight Adverse** (Not Significant)	Minerals are at depth and are already primarily covered by existing development. The Proposed Development Site does not preclude the future extraction of these minerals.	**Slight Adverse (Not Significant)**	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Minerals Shallow Resources Marine dredge Sand and Gravel	**Medium**	**Minor** (Safeguarded under the Tees Valley Joint Minerals and Waste Development Minerals and Waste Core Strategy DPD)	**Slight Adverse** (Not Significant)	Minerals are at depth and are already primarily covered by existing development. The Proposed Development Site does not preclude the future extraction of these minerals.	**Slight Adverse (Not Significant)**	T
Soils Agricultural Land Classification	**Medium/High**	**Minor** (From extraction / removal)	**Slight or Moderate Adverse** (Significant)	Soils to be stockpiled and re-used within landscaping areas.	**Slight Adverse (Not Significant)**	P
Soils General	**Medium**	**Minor** (From spoil resulting from excavations and earthworks)	**Slight Adverse** (Not Significant)	GI is required to confirm baseline assumptions. All earthworks operations will need to be undertaken in accordance with BS6031:2009 'Code of Practice for Earthworks' and applicable guidelines including MCHW Series 600 'Earthworks'.	**Slight Adverse (Not Significant)**	T

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
				Scheme will actively work towards achieving an earthworks balance.		
Groundwater (Bedrock Contamination) Principal Aquifer Sherwood Sandstone	**High**	**Minor** (from changes to hydrogeological regime. Mobilisation of contaminants during construction)	**Slight or Moderate Adverse** (Significant)	GI and groundwater level and quality to confirm baseline assumptions. Construction of piled foundations or deep excavations resulting in disturbance of the Sherwood Sandstone are not anticipated over the length of the Hydrogen Pipeline Corridor.	**Slight Adverse (Not Significant)**	P/T
Groundwater (Bedrock Contamination) Secondary Aquifer – B Mercia Mudstone	**Medium**	**Minor** (from changes to hydrogeological regime. Mobilisation of contaminants during construction)	**Slight Adverse** (Not Significant)	GI and groundwater level and quality to confirm baseline assumptions. The need for piling works will be assessed following GI works and/or foundation design. Any piling works required would be planned in	**Slight Adverse (Not Significant)**	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Group – Mudstone and Penarth Group – Mudstone Secondary Undifferentiated Redcar Mudstone Formation – Mudstone				accordance with best practice guidance 'Piling and Penetrative Ground Improvement. Methods on Land Affected by Contamination: Guidance on Pollution Prevention', EA National Groundwater & Contaminated and Centre Report NC/99/73. Any piling operations required 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. Where contaminated soils and elevated groundwater levels are proved by GI and piling is required, consideration to be given		

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
				construction of cased rotary bored piled foundations to remove potential pathway between Made Ground and underlying bedrock aquifer.		
Groundwater – (Soil Contamination) Secondary Aquifer – A Blown Sand Beach and Tidal Flat Deposits	**Medium**	**Minor** (from potential mobilisation of existing contaminants during construction. New contaminant pathways or mobilisation of existing contaminants may result from exposure of soils/increase in rainwater infiltration through changes in ground cover/in excavations)	**Slight Adverse** (Not Significant)	Remedial measures likely to comprise clean cover layer/capping. (Resultant effect may be beneficial).	**Slight Adverse (Not Significant)**	T
Groundwater – (Soil Contamination)	**Medium**	**Minor** (from Potential mobilisation of existing contaminants during construction. New contaminant pathways or	**Slight Adverse** (Not Significant)	Remedial measures likely to comprise clean cover layer/capping. (Resultant effect may be beneficial).	**Slight Adverse (Not Significant)**	T

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Secondary Aquifer – Undifferentiated Tidal Flat Deposits – Sand and Silt Tidal Flat Deposits – Sand, Silt and Clay		mobilisation of existing contaminants may result from exposure of soils/increases in rainwater infiltration through changes in ground cover/in excavations)				
Contamination (Soils) Blown Sand Tidal Flat Deposits	**High**	**Minor** (from potential contaminant pathways are reduced or removed by construction of remedial works including clean cover or capping layer as well as through construction of new structures, hardstanding,	**Slight or Moderate Beneficial** (Significant)	Note DMRB LA104, does not include for a magnitude category 'Beneficial' category. However, any remedial works such as placement of clean cover, soil treatment, soil stabilisation, removal of localised 'hotspots' of identified contamination	**Slight or Moderate Beneficial (Significant)**	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
		pavements over existing contaminated soils. Infiltration and pathways are reduced)		would provide improvement to the existing condition. GI and soils testing is required to quantify potential contamination and confirm baseline assumptions.		
Contamination (Soils) Blown Sand Tidal Flat Deposits - Sand and Silt Tidal Flat Deposits – Sand, Silt and Clay Glaciolacustrine	**Low**	**Minor** (from potential contaminant pathways are reduced or removed by construction of remedial works including clean cover or capping layer as well as through construction of new structures, hardstanding, pavements over existing contaminated soils. Infiltration and pathways are reduced)	**Neutral or Slight Beneficial** (Not Significant)	Note DMRB LA 104, does not include for a magnitude category 'Beneficial' category. However, any remedial works such as placement of clean cover, soil treatment, soil stabilisation, removal of localised 'hotspots' of identified contamination would provide improvement to the existing condition. GI and soils testing is required to quantify potential contamination and confirm baseline assumptions.	**Neutral or Slight Beneficial (Not Significant)**	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Deposits, Clay and Silt. Glaciofluvial Deposits, Sand and Gravel. Glacial Till, Devensian – Diamicton						
Operation						
Contamination (Soils) Blown Sand Tidal Flat Deposits	**High**	**Minor** (from impacts on soil quality could potentially occur during operation caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids)	**Slight or Moderate Adverse** (Significant)	Storage and handling of processed chemicals to be undertaken in properly surfaced and bunded areas. All bunded area will provide 110% of stored volume and constructed with impermeable materials.	**Slight Adverse (Not Significant)**	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
				Rapid spill response planning and training and the implementation of EMS.		
Groundwater (Bedrock Contamination) Principal Aquifer Secondary B Aquifers Secondary Undifferentiated	**Medium / High**	**Minor** (Impacts on groundwater and watercourses could potentially occur during operation caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids)	**Slight or Moderate Adverse** (Significant)	Storage and handling of processed chemicals to be undertaken in properly surfaced and bunded areas. All bunded area will provide 110% of stored volume and constructed with impermeable materials. Rapid spill response planning and training and the implementation of EMS.	**Slight Adverse (Not Significant)**	P
Decommissioning						
Contamination (Soils)	**Medium**	**Minor** (from excavation of materials/soil removal Demolition workers exposed to historic and current potentially	Slight Adverse (Not Significant)	Ground investigation to be undertaken to inform any earthworks to be undertaken as part of the decommissioning works.	**Slight Adverse (Not Significant)**	T

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
		contaminated soil sources on Site)				
Contamination (Soils)	**Medium**	**Minor** (from accidental spills. Impacts on soil quality could potentially occur during decommissioning caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids)	**Slight Adverse** (Not Significant)	-	-	T
Groundwater (Bedrock Contamination) Principal Aquifer Secondary A	**Medium / High**	**Minor** (from impacts on groundwater and watercourses could potentially occur during decommissioning caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored	**Slight Adverse** (Not Significant)	-	-	T

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Secondary Undifferentiated		chemicals and processed liquids)				
Soils (General)	**Medium**	**Minor** (from export, excavation, stockpiling, redistribution and/or removal of the Made Ground)	**Slight Adverse** (Not Significant)	All earthworks operations will need to be undertaken in accordance with BS6031:2009 'Code of Practice for Earthworks' and applicable guidelines including MHCW Series 600 'Earthworks'.	**Slight Adverse (Not Significant)**	T

Note: Lt = long term, Mt = medium term, St = short term, P = permanent, T = temporary

Construction

10.6.4 The Proposed Development Site may require supporting infrastructure which may impact the geology, hydrogeology and contaminated land. This may include foundation construction (e.g. piled supports, strip and pad footings), earthworks and excavations (foundations and service conduits).

10.6.5 Most of the impacts relating to geology, hydrogeology and contaminated land that are expected to arise as a result of the Proposed Development are anticipated to occur during construction.

10.6.6 Activities that may result in potential impacts to ground and groundwater at the Proposed Development Site include the following:

- creation of new contaminant linkages (e.g. pile foundation construction through existing Made Ground into underlying natural soils or bedrock, pile foundation construction or excavation through an existing aquiclude (impermeable fine/cohesive soils) into an aquifer (comprised of coarse or sandy soils);
- the mobilisation of existing contaminants via the exposure of soils/increases in rainwater infiltration through changes in ground cover/in excavations or bulk earthworks;
- changes to the hydrogeological regime (e.g. dewatering activities) may impact groundwater;
- surface water quantity and quality changes, and potential effects on surface water supplies, surface water run-off and drainage quantity and quality could result due to activities relating to bulk earthworks;
- activities relating to foundation construction, earthworks and excavations and associated transportation activities have the potential to expose construction workers to potentially contaminated dust;
- on site construction traffic, through compaction of the existing soils, could increase the speed of surface water run-off and increase the potential for erosion and transportation of sediment; and
- potential temporary impacts 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 polluting potential (e.g., concrete, fuel, oils and soil) which have the potential to be mobilised to ground or controlled waters.

10.6.7 Potential impacts associated with risks of major accidents and disasters (by leaks or spillages for example) are assessed in Chapter 20: Major Accidents and Disasters (PEI Report, Volume I).

10.6.8 There may also be beneficial effects if any previously unidentified contaminated soil is identified and remediated and have been assessed as Slight Beneficial (Non-Significant).

Geology

10.6.9 There are no bedrock exposures or outcrops present within the Proposed Development Site. Potential impacts upon the underlying geology are primarily related to the potential risk of creating a new Source-Pathway-Receptor linkage.

10.6.10 As indicated in in Table 10-12, geological effects during the construction of the Proposed Development (taking into account the mitigation measures as detailed in Section 10.5) would be no worse than Slight Adverse (Not Significant).

Mineral Resources

10.6.11 Mineral resources are present at depth below the Proposed Development Site and are already primarily covered by existing industrial development at the Main Site. It is not anticipated that the construction of the Proposed Development Site would preclude the potential future extraction of these minerals.

10.6.12 As indicated in Table 10-12: Summary of Geology, Hydrogeology and Contaminated Land Effects, effects upon mineral resources during Proposed Development Site construction (taking into account the mitigation measures as detailed in Section 10.5) would be no worse than Slight Adverse (Not Significant).

Potential Soil Resource and Agricultural Land Quality

10.6.13 The Proposed Development Site is largely already covered in Made Ground or in industrial land use. Soils are predominantly recorded as Grade 4 or 5 and are Non-Agricultural/Urban. Therefore, the magnitude of impact associated with the loss of such soils (Low value) during the construction of the Proposed Development would be considered Negligible, resulting in Slight effects (Not Significant).

10.6.14 However, localised parts of the Hydrogen Pipeline Corridor north of the River Tees are of ALC Grade 3 (subgrade not distinguished) agricultural land. The area of land is along a road with Billingham Cemetery located adjacent to the road and the remainder of the area is covered by trees. The potential impact of the Proposed Development on this resource is considered to be Minor, with effects considered to be Slight Adverse (Not Significant).

Hydrogeology – Changes to Hydrogeological Regime

10.6.15 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 be likely to result in the lowering of groundwater levels in the immediate area of the excavation. 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. The potential impact to Proposed Development Site is considered to be Slight Adverse (Not Significant).

10.6.16 With appropriate design of Proposed Development Site construction activities and the implementation of the measures included in the CEMP, it is anticipated that

impacts would be no worse than Minor, resulting in effects no more than Slight Adverse (Not Significant).

Controlled Waters – Contamination

10.6.17 The Proposed Development Site construction works have the potential to impact upon controlled water – pathways (without mitigation) include the following:

- Potential effects upon groundwater could arise from contamination of the Secondary 'A' Aquifers. Disturbance and/or removal of the ground and groundwater could potentially remove, relocate or mobilise potential contaminants e.g., during foundation construction, earthworks and excavations. The potential impact of the Proposed Development Site is considered to be Slight Adverse (Not Significant).
- Pollution of groundwater (and surface water) could result from concrete, fuel, oil and hydrocarbon spillages. The risk of pollution is greater near to excavations where higher permeability strata are exposed i.e., close to the River Tees within the Tidal Flat Deposits or across connection corridors that extend through the Blown Sands. The potential impact of the Proposed Development Site is considered to be Slight Adverse (Not Significant).
- Creation of new potential contaminant linkages e.g., pile foundation construction through existing Made Ground into underlying natural soils or bedrock, or pile foundation construction or excavation through an existing aquiclude (impermeable fine/cohesive soils) into an aquifer (comprised of coarse or sandy soils). The potential impact of the Proposed Development Site is considered to be Slight Adverse (Not Significant). A Piling Risk Assessment will be undertaken to mitigate the risks from foundation construction.
- 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. The potential impact of the Proposed Development Site is considered to be Neutral or Slight Adverse (Not Significant).
- Changes to the hydrogeological regime and potential mobilisation of contamination into groundwater during construction (and decommissioning) and potential effects on groundwater aquifers e.g., from dewatering activity required as part of construction. The potential impact of the Proposed Development Site is considered to be Slight Adverse (Not Significant).
- Surface water quantity and quality changes during construction (and decommissioning) and potential effects on surface water supplies, surface water run-off and drainage quantity and quality e.g., during bulk earthworks. All works will comply with either a water management plan and any abstraction/discharge permits required.

10.6.18 With appropriate design of the Proposed Development Site construction activities and the implementation of the measures included in the CEMP, it is anticipated that

impacts would be no worse than Minor, resulting in effects no more than Slight Adverse (Not Significant).

Operation

10.6.19 The operational impacts of the Proposed Development Site with regards to geology, hydrogeology and contaminated land are associated with the permanent site infrastructure which includes plant and buildings, roadways, service corridors and areas of hardstanding.

10.6.20 The potential impacts (without mitigation) that could arise during the operational phase of the Proposed Development include:

- Impacts to soil quality, groundwater and watercourses could potentially occur during operation as a result of accidental spills from the handling or leakage of fuels, lubricants, stored chemicals and process liquids. The potential impact of the Proposed Development Site is considered to be Slight Adverse (Not Significant).

10.6.21 With appropriate operational management of the Proposed Development Site in accordance with the Environmental Permit, it is anticipated that impacts would be Negligible, resulting in effects no more than Slight Adverse (Not Significant).

Decommissioning

10.6.22 At the end of its design life, decommissioning of the Proposed Development Site is anticipated to involve the removal of all above ground equipment down to ground level. It is assumed that all underground infrastructure will remain in-situ; however, all connection and access points will be sealed or grouted to ensure disconnection.

10.6.23 As detailed in Section 10.5, a DEMP would be prepared and implemented that would consider potential environmental risks on the Proposed Development Site and contain guidance on how risks can be removed or mitigated. With the implementation of the DEMP, it is assumed that decommissioning impacts would be similar to those experienced during construction as discussed above.

10.6.24 As such, with the implementation of the measures as detailed in the DEMP, geology, soils, hydrogeology and contaminated land effects are anticipated to be no worse than Slight Adverse (Not Significant).

10.7 Mitigation and Enhancement Measures

10.7.1 Section 10.6 indicates that with the implementation of the mitigation measures as detailed in Section 10.5, significant effects associated with geology, hydrogeology and contaminated land are anticipated to be avoided and thus additional mitigation measures are not anticipated to be required.

10.7.2 However, prior to the design and construction of the Proposed Development, a GI will be undertaken to determine ground conditions. The results of the GI may indicate the need to undertake a further risk-based assessment to develop the current CSM that has been produced. This will also involve further assessment of the contamination sources, receptors, and plausible pollutant linkages at the Proposed

Development Site, in accordance with government guidance and the UK framework for the assessment of risk arising from contaminated land. The assessment will use principles adopted by the EA in Land Contamination: Risk Management (2021). The significance of impacts will take into account the principles of assessment identified in CIRIA Report C552, (CIRIA, 2011) and EAs guiding principles for land contamination in assessing risks to controlled waters (EA, 2010). Any such risk-based assessment may indicate the need for mitigation measures additional to those as detailed herein.

10.7.3 A piling risk assessment will be undertaken to determine the risk of possible contaminants becoming mobile and migrating through soils to receptors by the installation of piles through Made Ground. The assessment will be in accordance with the EA's guidance documents including, piling into contaminated sites (EA, 2001) and will determine the risk to receptors through potential pollution scenarios.

10.8 Limitations and Difficulties

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

- the assessment undertaken is based on the collation and evaluation of available information obtained from the EA, BGS, Groundsure Report and other sources made available;
- a site-specific GI was not available during the time of writing (August 2023); however, GI will be undertaken at the Main Site, based on the findings of the desk study, to assess the presence of contamination and determine the impacts this may have on site users and the environment. The findings will inform the identification of mitigation measures, the detailed design, the CEMP and management plans for the operation and decommissioning phases of the Proposed Development.

10.9 Residual Effects and Conclusions

10.9.1 The effects of the Proposed Development Site following the implementation of additional mitigation measures are known as 'residual effects.' The residual effects range between Neutral (Not Significant) and Slight Adverse (Not Significant) for the Proposed Development Site during the construction, operation (including maintenance) and decommissioning phases as presented in Table 10-12.

10.10 References

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