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Appendix 10A – Geology, Hydrogeology and Land Contamination Desk Based Summary Report
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Appendix 10C – Contaminated Land Environmental Risk Assessment
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10.0 GEOLOGY, HYDROGEOLOGY AND CONTAMINATED LAND

10.1 Introduction

10.1.1 This chapter of the Environmental Statement (ES) identifies the potential impacts and effects on geology, hydrogeology and contaminated land that have been considered as part of the Environmental Impact Assessment (EIA) of the Proposed Development. The assessment has been undertaken in accordance with best practice guidance, and consideration has been given to geology: superficial soils and bedrock, geological and hydrogeological designations, soils and Agricultural Land Classification (ALC), land contamination and minerals.

10.2 Legislation, Planning Policy Context and Other Guidance

10.2.1 This section identifies and describes legislation, planning policy and guidance that is of relevance to the assessment of geology, hydrogeology and contaminated land effects.

Planning Policy Context

National Planning Policy

National Policy Statements

10.2.2 The revised National Policy Statements for energy infrastructure were published by the Government on 22 November 2023, following consultation in March 2023, and were designated (i.e. came into force) on 17 January 2024. Therefore, the revised NPSs are relevant policy for applications for development consent submitted and accepted for examination following their designation.

10.2.3 The following recently designated revised energy NPSs are considered of relevance to the Proposed Development:

- the Overarching NPS for Energy (EN-1) (DESNZ, 2023);
- the NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (DESNZ, 2023); and
- the NPS for Electricity Networks Infrastructure (EN-5) (DESNZ, 2023).

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

10.2.4 The NPS for Energy (EN-1) (Department for Energy Security and Net Zero, 2023a) was published in November 2023 and is of relevance to the geology, hydrogeology and contaminated land assessment.

10.2.5 Section 4.12 (Pollution control and other environmental regulatory regimes) (Department for Energy Security and Net Zero (DESNZ), 2023a) includes consideration for discharges or emissions and indirect or direct impacts to terrestrial, freshwater, marine, onshore and offshore environments, or which include noise and vibration may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes.

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- 10.2.6 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.
- 10.2.7 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.
- National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (2023)*
- 10.2.8 A revised version of the NPS for Gas Supply Infrastructure and Gas and Oil Pipeline (EN-4) (DECC, 2023b) was published in November 2023. This NPS is of relevance to the geology, hydrogeology and contaminated land assessment as the Proposed Development includes pipeline infrastructure including a natural gas supply pipeline and hydrogen distribution pipelines. The NPS is noted to refer to 'Natural Gas' rather than 'Gas' as within the previous NPS EN-4.
- 10.2.9 Section 2.3 (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.
- 10.2.10 Section 2.8 (Underground Natural Gas Storage) and 2.9 (Underground Natural Gas Storage: Applicant assessment) sets out the limitations of site selection of underground storage and considerations 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.
- 10.2.11 Section 2.10 provides details on the mitigation measures for underground natural gas storage including measures to control the abstraction of water including abstraction licences and Environmental Permits. The disposal of brine into an underground reservoir or the sea requires an Environmental Permit or discharge consents.
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- 10.2.12 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. This includes consideration for proposals of horizontal directional drilling (HDD) and whether the geological conditions are suitable. Paragraph 2.21.49 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."*
- 10.2.13 Section 2.22 (Natural Gas and Oil Pipelines: Mitigation) details mitigation measures for soil and geology including appropriate treatment of soil in line with the principles and practices outlined in the Code of Practice for the Sustainable Management of Soils on Construction Sites. Typical design mitigation measures to protect water quality are also summarised including avoidance of vulnerable groundwater areas, careful storage of excavated material away from watercourses and careful reinstatement of riverbanks and reed beds. The section further details possible appropriate mitigation measures.
- 10.2.14 Section 2.23 (Natural Gas and Oil Pipelines: Secretary of State decision making) details the requirement to consider the impact to soil and geology. It is noted that the proposed route and other measures (if applicable) eliminates or reduces adverse impacts to an acceptable level, whilst not adversely affecting the integrity of the pipeline. This section also notes that the impacts on water quality and resources should be acceptable.
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023)*
- 10.2.15 A revised version of the NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2023c) was published in November 2023. This NPS is of relevance to the geology, hydrogeology and contaminated land assessment as the Proposed Development includes electricity grid connection infrastructure.
- 10.2.16 Section 2.6 (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.
- 10.2.17 Paragraph 2.9.25 details the disruptive effects of undergrounding on the environment, archaeological sites, sensitive habitats, soils and geology and damage heritage assets.
- 10.2.18 Section 2.9 (Applicant assessment) details the impacts the Applicant should consider. However, it notes that the list is not exhaustive and site-specific
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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.

- 10.2.19 Section 2.14 (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 consideration of sulphur hexafluoride on the environment.

The National Planning Policy Framework (December, 2023)

- 10.2.20 The National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities (DLUHC), December 2023) sets out the government's planning policies for England and how these are expected to be applied. The NPPF 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 DLUHC with recommendations to the government on the NPPF.
- 10.2.21 Paragraph 65 states *'Provision of affordable housing should not be sought for residential developments that are not major developments, other than in designated rural areas (where policies may set out a lower threshold of 5 units or fewer). To support the re-use of brownfield land, where vacant buildings are being reused or redeveloped, any affordable housing contribution due should be reduced by a proportionate amount.'*
- 10.2.22 Paragraph 123 states *'Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.'*
- 10.2.23 Paragraph 124 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.'*
- 10.2.24 Paragraph 146 a states *'makes as much use as possible of suitable brownfield sites and underutilised land.'*
- 10.2.25 Paragraph 180 f states *'Planning policies and decisions should contribute to and enhance the natural and local environment by remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.'*
- 10.2.26 Paragraph 189 states *'Planning policies and decisions should ensure that: a) a site is suitable for its proposed use taking account of ground conditions and any risks*
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arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); b) 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; and adequate site investigation information, prepared by a competent person, is available to inform these assessments.'

- 10.2.27 Paragraph 190 states *'Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.'*

Planning Practice Guidance (2019)

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

A Green Future: Our 25 Year Plan to Improve the Environment

- 10.2.29 The 25 Year Environment Plan sets out government action to help the natural world regain and retain good health. It aims to deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats. It calls for an approach to agriculture, forestry, land use and fishing that puts the environment first.
- 10.2.30 Policy 3 of Chapter 1 (Using and managing land sustainability) details the aims to *improve soil health and restoring and protecting peatlands.*
- 10.2.31 Policy 2 of Chapter 4 (Increasing resource efficiency and reducing pollution and waste) details the aims at *reducing pollution including minimising the risk of chemical contamination in our water.*
- Environmental Improvement Plan 2023*
- 10.2.32 The Environmental Improvement Plan presents the delivery plan for the environment to building a greener more prosperous country.
- 10.2.33 The plan aims to deliver on ten environmental goals with an apex goal of thriving plants and wildlife.
- 10.2.34 Goal four (managing exposure to chemicals and pesticides) includes *support partners to manage waste streams that are contaminated with persistent organic pollutants (POPs) to ensure that they are destroyed at end of life and reduce the levels of POPs entering by ensuring chemicals are safely used and managed the environment.*
- 10.2.35 Goal six (using resources from nature sustainably) includes *improving and protecting soil health.*

10.2.36 Goal ten (enhancing beauty, heritage and engagement with the natural environment) includes *reinforce the natural, geological and cultural heritage of our landscapes*. This includes monitoring and evaluating the *condition of heritage features including geological sites and scheduled monuments*.

10.2.37 The plan discusses the aim of improving our use of resources which will include *publish a baseline map of soil health for England by 2028 and bring at least 40% of England's agricultural soil into sustainable management by 2028*.

Local Planning Policy

South Tees Regeneration Master Plan (2017)

10.2.38 This Master Plan presents the vision, strategy and ideas for the transformational regeneration of the South Tees Development Corporation area into world class employment-generating zone and economic growth enabler for the Tees Valley. The Master Plan presents a summary of the existing ground conditions (Section 2.11.), a Ground Conditions – Potential Major Hazards Zones, understanding ground conditions (Section 13.04.) and states the following relevant constraint:

- *Contamination: The types of use possible across the STDC area will be influenced by ground conditions and ground contamination, as full-scale decontamination is neither proposed nor financially viable. Residential dwellings would likely be unsuitable for the site.*

Redcar and Cleveland Borough Council Local Plan (2018)

10.2.39 The following policies and statements of the Redcar and Cleveland Borough Council (RCBC) Local Plan and Policies Map (RCBC, 2018a) 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; and*
 - *South Tees Industrial Estates and Business Parks.”*

10.2.40 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 and Cleveland, South Tees Area Supplementary Planning Document (May 2018)

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

- Development Principle STDC1: 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; and
 - *“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.”*

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- *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; and*
 - *All proposals will be required to have regard to the forthcoming Environment and Biodiversity and Open Space Strategies and, where appropriate, the Redcar and 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 must, 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;*

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- *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 must 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; and*
 - *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)

10.2.42 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."*

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- 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*
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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)

10.2.43 The following policies and statements of the Hartlepool Borough Council (HBC) 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 16.36 – *"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."*
- 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.”

Other Guidance and Legislation

- 10.2.44 This section covers EU legislation and UK legislation, regulations and applicable guidance.
- 10.2.45 The UK left the EU on 31 January 2020. The legislation discussed in this section remains applicable to the Geology, Hydrogeology and Contaminated Land chapter.

EU Legislation

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

- 10.2.46 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)

- 10.2.47 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)

- 10.2.48 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)

- 10.2.49 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

- 10.2.50 The UK's approach to contaminated land management is primarily governed by Part IIA of the Environmental Protection Act 1990 (Part 2A), which came into force in April 2000. This legislation establishes the legal framework for identifying and remediating contaminated land across the UK. Contaminated land is legally defined as land where substances are causing or could cause significant harm to people, property or protected species; and significant pollution of surface waters or groundwater. Enforcing authorities are required to identify and deal with such land.

The Environment Act (1995)

- 10.2.51 The Environment Act (HM Government, 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)

- 10.2.52 The Environment Act (HM Government, 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)

- 10.2.53 The Act (HM Government, 2003) provides measures with regards to holding and issuing licences for water abstractions. The four broad aims of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation. 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 (HM Government, 1991a) and Water Industry Act (HM Government, 1991b).

The Water Act (2014)

- 10.2.54 The aim of the Act (HM Government, 2014a) 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)

- 10.2.55 The Act (HM Government, 1991a) 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)

- 10.2.56 These Regulations (HM Government, 1991) 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)

- 10.2.57 The Regulations (HM Government, 2016) (HM Government, 2019) 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)

- 10.2.58 The Regulations (HM Government, 2015) 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)

- 10.2.59 The Contaminated Land Regulations (HM Government, 2012) set out the processes of risk assessment and identification/evaluation of remediation options. This is an amendment of the 2006 Contaminated Land (England) Regulations (HM Government, 2006).

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

- 10.2.60 The Regulations (HM Government, 2014b) 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.

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 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 One is operational and Phase Two is under construction.

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

10.3.4 The study area for geology, hydrogeology and contaminated land is the entirety of the ground within the Proposed Development Site (Figure 4-1, ES Volume II, EN070009/APP/6.3), 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, 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 the Design Manual for Roads and Bridges (DMRB) LA109 Geology and Soils (National Highways, 2019a). The study area distance has been used to identify potential receptors such as designated sites as well as identifying sources such as landfills. The environmental datasets obtained for the site included a 1 km buffer for the Proposed Development Site. 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;

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- 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), which is included as part of this chapter within Appendix 10B (ES Volume III, EN070009/APP/6.4).
- 10.3.8 To facilitate the impact assessment process and ensure consistency in the terminology of effect significance, the standard assessment methodology discussed in Chapter 2: Assessment Methodology (ES Volume I, EN070009/APP/6.2) has been applied.
- 10.3.9 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), DMRB LA113 (National Highways, 2020), DMRB LA 104 (National Highways, 2020), Land Contamination: Risk Management (EA, 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, 2020).

Value/ Sensitivity of Receptors

- 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.

Table 10-1: Sensitivity (Value) of Geology, Soil and Water Environment Attributes (Adapted from DMRB LA109 Table 3.11 (National Highways, 2019a) and DMRB LA113 Table 3.70 (National Highways, 2020) 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 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 EU designated site.	Soils	Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar Site; and/or ALC Grades 1 and 2 (as defined in Table 10-7).
	Human Health: very high sensitivity land use.	Contamination	Residential or allotments.
	Nationally significant attribute of high importance.	Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site designated under EC and UK legislation. Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). Source Protection Zone (SPZ1).
High	Rare and of national importance with little potential for replacement.	Geology	Geological SSSIs and National Nature Reserves (NNRs).

RECEPTOR VALUE (SENSITIVITY IMPORTANCE)	CRITERIA	ASPECT	TYPICAL EXAMPLES
	Geology meeting national designation citation criteria which is not designated as such.		
	Soils directly supporting a UK designated site.	Soils	e.g. SSSIs; and/or 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

Magnitude of Impacts

- 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).
- 10.3.13 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 in line with DMRB LA 113 (National Highways, 2020). The criteria for determining the magnitude of impact upon receptors are provided in Table 10-2.

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

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
Major Adverse	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.
	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 $\geq 2\%$ 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 Adverse	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.
	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 to 250. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually.

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
			<p>Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification.</p> <p>Damage to major structures through subsidence or similar effects or loss of minor structures.</p>
Minor Adverse	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.
	Results in some measurable change in attributes, quality or vulnerability.	Groundwater	<p>Potential low risk of pollution to groundwater from routine runoff – risk score <150.</p> <p>Calculated risk of pollution from spillages ≥0.5% annually and <1% annually.</p> <p>Minor effects on an aquifer, GWDTEs, abstractions and structures.</p>

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
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.
		Soils	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.
	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.
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.

MAGNITUDE	CRITERIA	ASPECT	TYPICAL DESCRIPTION
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

10.3.14 Once the value (sensitivity) 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, 2020) has been used to determine the effect significance reproduced in Table 10-3.

10.3.15 Table 10-4 presents the significance of each effect.

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 of Effect

EFFECT	SIGNIFICANCE
Very large	Significant
Large	Significant
Moderate	Significant
Slight	Not significant
Neutral	No change, not significant

Cumulative Geology Effects

10.3.16 An assessment of cumulative geology effects has been undertaken and is detailed within Chapter 23: Cumulative and Combined Effects (ES Volume I, EN070009/APP/6.2).

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- 10.3.17 The assessment of cumulative effects follows the methodology described in Advice Note Seventeen (The Inspectorate, 2019a), for more information refer to Chapter 23: Cumulative and Combined Effects (ES Volume I, EN070009/APP/6.2).
- 10.3.18 It is important to note that cumulative effects may vary from the effects of the Proposed Development considered in isolation. For example, it is possible for the Proposed Development to have greater effects cumulatively with other planned developments than if it is considered in isolation against the existing baseline reported in Section 10.4.

Sources of Information/ Data

- 10.3.19 Current baseline conditions have been determined by a desk-based review of available information and relevant available published reports. The full desk-based review is included at Appendix 10A (ES Volume III, EN070009/APP/6.4). The baseline characterisation is considered to be sufficient to inform this assessment.
- 10.3.20 Confirmatory intrusive ground investigation (GI) will be undertaken to support the assessments and will also be used to inform the Proposed Development Site detailed design.
- 10.3.21 The scope of the GI will be forwarded to the relevant authorities as appropriate prior to commencing works. This is envisaged to include informing Local Authorities if appropriate for GI associated with pipeline routes. For areas near sensitive ecological receptors relevant stakeholders will be engaged with including obtaining the MMO for the over water GI.

Conceptual Site Model

- 10.3.22 Appendix 10B: Contaminated Land Conceptual Site Model (CSM) (ES Volume III, EN070009/APP/6.4) has been prepared using a Source-Pathway-Receptor CSM model to identify potential pathways by which sources of contamination may impact on identified receptors. The CSM has been used to inform the assessment of the potential impact of the Proposed Development for geology, soils, hydrogeology and contaminated land receptors in this ES.

Environmental Risk Assessment

- 10.3.23 Based upon the CSM produced for the Proposed Development Site (Appendix 10B, ES Volume III, EN070009/APP/6.4), an evaluation of the risks posed by the identified potential pollutant linkages at the Proposed Development Site has been prepared and is presented in Appendix 10C: Contaminated Land Environmental Risk Assessment (ES Volume III, EN070009/APP/6.4). The Environmental Risk Assessment has been used to assess the potential impact of the Proposed Development for geology, soils, hydrogeology and contaminated land receptors in this ES.

Geotechnical Risk Register

- 10.3.24 A Preliminary Engineering Assessment and Geotechnical Risk Register is described in detail within Appendix 10D: Geotechnical Risk Register (ES Volume III, EN070009/APP/6.4).

Summary of Resource Value

10.3.25 This assessment considers the following resources:

- geology; artificial ground, superficial deposits and bedrock;
- minerals;
- hydrogeological aquifer designations;
- soils and agricultural land classification; and
- contamination to soils and groundwater.

Consultation

Scoping Opinion

10.3.26 An EIA Scoping Opinion was requested from the Inspectorate on 6 April 2023. A response was received on 17 May 2023. For the Scoping Opinion and the Applicant's responses to them, refer to Appendix 1E (ES Volume III, EN070009/APP/6.4).

Statutory Consultation

10.3.27 The PEI Report was published for statutory consultation on 14 September 2023 and the consultation period ended on 26 October 2023. A second statutory consultation was held between 13 December 2023 and 23 January 2024, and additional targeted consultation was held between 9 February 2024 and 10 March 2024. The matters raised have been reviewed and an explanation of how the Applicant has had regard to them is set out in the Consultation Report (EN070009/APP/5.1).

10.3.28 Refer to Table 10-5 for a detailed summary of the Statutory Consultation feedback relevant to this chapter from Statutory Environmental Bodies, and the Applicant's responses.

Table 10-5: Responses to the Statutory Consultation Feedback

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
Natural England	20/10/23	<p>Natural England's comments relating to the Public Consultation and the Preliminary Environmental Information Report (PEIR) are given below:</p> <p>Soils and Best and best and most versatile land</p> <p>Natural England notes the submitted information detailing agricultural land classification (ALC) for land affected by the development. We acknowledge the predominantly lower grades of, and non-agricultural, land recorded within the development site. In addition to best and most versatile land considerations for the identified Grade 3 land north of the R.Tees we would emphasise the important need for conservation of soil resources more generally. We therefore note and welcome reference to the Code of Practice for the Sustainable Management of Soils on Construction Sites, for example in respect of proposals for horizontal directional drilling (HDD) beneath the R.Tees and Greatham Crook.</p>	<p>Soils and Best and best and most versatile land</p> <p>The assessment reflects the importance of soil as a resource with reference to the Code of Practice for the Sustainable Management of Soils on Construction Sites.</p>
Environment Agency	26/10/23	<p>Groundwater</p> <p>The information within the Preliminary Environmental Information Report (PEIR) appears robust, follows appropriate guidance and assessment methodologies</p>	<p>Groundwater</p> <p>Table 10-10 in Chapter 10: Geology, Hydrogeology and Contaminated Land (ES Volume I, EN070009/APP/6.2) has been</p>

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		<p>and considers the mitigation requirements should any adverse effect be found.</p> <p>The Sherwood Sandstone principal aquifer should be included as a receptor within PEIR Chapter 10 Table 10-10. This receptor has been omitted from this table, but is referred to elsewhere, specifically within the proposed area of the hydrogen corridor.</p>	<p>updated to include the Sherwood Sandstone Principal Aquifer.</p>

Use of the Rochdale Envelope

- 10.3.29 In order to ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the EIA is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate in line with the Planning Inspectorate's ('the Inspectorate's') Advice Note 9 (The Inspectorate, 2018). This involves assessing the maximum (or where relevant, minimum)/ realistic worst-case parameters (e.g. for construction activities, whole development footprint) for the elements where flexibility needs to be retained (building dimensions or operational modes for example).
- 10.3.30 The construction of the development will be undertaken in two phases, Phase 1 and Phase 2 with a potential overlap of the phases anticipated, where Phase 1 of the Hydrogen Production Facility may become operational whilst Phase 2 is under construction. The assessment presented in this chapter has taken this into account by considering the introduction of industrial workers to the operational Phase 1 area whilst construction work is undertaken in the Phase 2 area. Human receptors during the construction works in the Phase 1 area are expected to be limited to construction workers. Construction workers will be protected through embedded mitigation of compliance with the requirements of the Construction, Design and Management Regulations 2015.
- 10.3.31 Given the above, this assessment presents a reasonable 'worst-case' approach.

Assumptions and Limitations

- 10.3.32 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 Reports and other sources made available.
 - A confirmatory GI will be undertaken to support geotechnical aspects and therefore detailed, design. Subsequent risk assessments will inform decisions about whether remediation works by the Applicant are necessary to supplement (or replace) remediation by STDC as described in 10.5.7. Timing implications are discussed in 10.5.7.
 - In the absence of confirmatory GI data, the assessment undertaken has been conservative.

10.4 Baseline Conditions

Existing Baseline

- 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 (Appendix 10A to 10C, ES Volume III, EN070009/APP/6.4).

10.4.2 Confirmatory GI will be undertaken to confirm ground conditions and chemical status. The data will be used to undertake risk assessments to inform detailed design of the Proposed Development Site and to support mitigation measures as described in 10.5.7.

Ecological Designations

10.4.3 Ecological designations are considered relevant to understanding the baseline conditions to geology, hydrogeology and contaminated land because the Teesmouth and Cleveland Coast SSSI, SPA and Ramsar are all designated as such in part due to the underlying geology present, specifically the mudflats, marshes and dunes. Ecological designations within the Proposed Development Site are summarised in Table 10-6 and are shown on Figure 10-10a to 10-10g (ES Volume II, EN070009/APP/6.3).

Table 10-6: Ecological Designations

SITE/RELEVANT FEATURE	DESCRIPTION
Main Site	No ecological designations are located within the Main Site. Teesmouth and Cleveland Coast SSSI directly north.
CO ₂ Export Corridor	No ecological designations are located within the CO ₂ Export Corridor. Teesmouth and Cleveland Coast SSSI directly north.
Natural Gas Connection Corridor	No ecological designations are located within the Natural Gas Connection Corridor. Teesmouth and Cleveland Coast SSSI directly north.
Water Connection Corridor	No ecological designations are located within the Water Connection Corridor. Teesmouth and Cleveland Coast SSSI directly north.
Electrical Connection Corridor	No ecological designations are located within the Electrical Connection Corridor. Teesmouth and Cleveland Coast SSSI directly north.
Hydrogen Pipeline Corridor	Ramsar Site (majority of corridor north of river Tees): Teesmouth And Cleveland Coast Reference: UK11068
	SSSI: Teesmouth And Cleveland Coast Reference: 1000263
	SPA (as Ramsar Site above): Teesmouth And Cleveland Coast

SITE/RELEVANT FEATURE	DESCRIPTION
	Reference: UK9006061
	Local Nature Reserve: Cowpen Bewley Woodland Park
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 (DEFRA, n.d.) 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 10-19a to 10-19g (ES Volume II, EN070009/APP/6.3) 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 are deemed to be Best and most Versatile (BMV) 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.
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 crops.

AGRICULTURAL LAND CLASSIFICATION	AGRICULTURAL LAND CLASSIFICATION DEFINITION
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 Definitions

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 – Entirety of the Corridor.
Electrical Connection Corridor	Urban and Non-Agricultural – Entirety of the Corridor.
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.

PART OF THE PROPOSED DEVELOPMENT SITE	AGRICULTURAL LAND CLASSIFICATION
	<p>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.</p> <p>Grade 4 – Adjacent to the Grade 5 Classification and encompassing Cowpen Bewley Woodland Park and the A1185 Road.</p> <p>Grade 3 – Parcel of land approximately 2ha in size for Cowpen Bewley Replacement Land. As a worst case scenario this has been assumed to be Grade 3a.</p> <p>N.B – a small portion of the northern extent of the Hydrogen Pipeline Corridor falls within Grade 3 land adjacent to Billingham Cemetery, However, it is noted that this area of land comprises a road. Therefore, is not considered further in this assessment.</p>
Hydrogen Pipeline Corridor, South Of River Tees	<p>Urban and Non-Agricultural – Entirety of the Corridor.</p> <p>N.B There is a low likelihood that Grade 2 ALC encroaches onto the east side of the southeastern extent at Lackenby industrial works area. However, it is considered that this is most likely to be a mapping overlay error as the area is already in industrial use, comprising a pipeline network. Therefore, it is not considered further in this assessment.</p>
Other Gases Connection Corridor	<p>Urban and Non-Agricultural – Entirety of the Corridor.</p>

Geology

- 10.4.5 The geology beneath the Proposed Development Site is shown on British Geological Survey (BGS) 1:50,000 Sheet 33 Stockton (BGS, 1987) and Sheet 34 Guisborough (BGS, 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 Figure 10-1a to 10-1g: Artificial Geology, Figure 10-2a to 10-2g: Superficial Geology and Figure 10-3a to 10-3g: Bedrock Geology (ES Volume II, EN070009/APP/6.3).
- 10.4.7 Note: BGS 1:10,000 Sheet NZ52NE (Warrenby) does not show the full extent of the superficial geology at the Proposed Development 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: Summary of Geology at the Proposal Development Site

SITE	ARTIFICIAL GEOLOGY (MADE GROUND)	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
Main Site	Present – most of the Main Site, apart from the north-eastern corner.	<p>Tidal Flat Deposits: BGS geological mapping anticipates that the Tidal Flat Deposits underlie the entirety of the Main Site. The BGS has provided two different layer types for these deposits; Sand and Silt and Sand, Silt and Clay, respectively, depending on which 1:50,000 geological map Sheet covers the area of interest. Across land covered by the Stockton sheet (Sheet 33) (BGS, 1987), the deposits are indicated to comprise Sand, Silt and Clay whilst further east on the Guisborough sheet (Sheet 34) (BGS, 1998) they are reported to comprise of Sand and Silt.</p> <p>Glaciolacustrine Deposits: It is anticipated that Glaciolacustrine Deposits will underlie the Tidal Flat Deposits.</p> <p>Till, Devensian: It is anticipated that Glacial Till Deposits will underlie the Tidal Flat Deposits and Glaciolacustrine Deposits.</p>	<p>Redcar Mudstone Formation (Lias Group): The south-east corner is anticipated to be underlain by the Redcar Mudstone Formation.</p> <p>Penarth Group (Rhaetian): A thin strip of land through the centre of the Main Site, and the Redcar Mudstone Formation are anticipated to be underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (Triassic): The north-west extent and the Penarth Group are anticipated to be overlain by the Mercia Mudstone Group.</p>
CO ₂ Export Corridor	Present – most of Corridor, apart from north-western corner	<p>Blown Sand: The north-east corner is underlain by Blown Sand Deposits.</p> <p>Tidal Flat Deposits: The remainder of the Corridor, and the Blown Sand Deposits are anticipated to be underlain by Tidal Flat Deposits.</p>	Redcar Mudstone Formation (Lias Group): The Redcar Mudstone Formation is anticipated to underlie most of the Corridor, apart from a small parcel of land in the north-west and south-west corner.

SITE	ARTIFICIAL GEOLOGY (MADE GROUND)	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
		<p>Glaciolacustrine Deposits: It is anticipated that Glaciolacustrine Deposits will underlie the Tidal Flat Deposits in places.</p> <p>Till, Devensian: It is anticipated that Glacial Till Deposits will underlie the Glaciolacustrine Deposits.</p>	<p>Penarth Group (Rhaetian): The north-west corner and far south-west corner and the Redcar Mudstone Formation are anticipated to be underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (Triassic): The Mercia Mudstone Group underlies the Penarth Group.</p>
Natural Gas Connection Corridor	Present – most of the Corridor, apart from a small parcel of land to the north.	<p>Blown Sand: The north extent is anticipated to be underlain by Blown Sands.</p> <p>Tidal Flat Deposits: The remainder of the Corridor and the Blown Sand Deposits are anticipated to be underlain by Tidal Flat Deposits.</p> <p>Glaciolacustrine Deposits: It is anticipated that Glaciolacustrine Deposits will underlie the Tidal Flat Deposits.</p> <p>Till, Devensian: It is anticipated that Glacial Till Deposits will underlie the Glaciolacustrine Deposits.</p>	<p>Redcar Mudstone Formation (Lias Group): The Redcar Mudstone Formation is anticipated to underlie most of the Corridor, apart from a small parcel of land in the far west.</p> <p>Penarth Group (Rhaetian): The west corner and the Redcar Mudstone Formation are anticipated to be underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (New Red Sandstone Supergroup): The Mercia Mudstone Group is anticipated to underlie the Penarth Group.</p>
Water Connection Corridor	Present – western extent of the Corridor.	<p>Blown Sand: The central area of the Corridor is anticipated to be underlain by Blown Sands.</p> <p>Tidal Flat Deposits: The remainder of the Corridor and the Blown Sand Deposits are anticipated to be underlain by Tidal Flat Deposits.</p>	<p>Redcar Mudstone Formation (Lower Lias): The Redcar Mudstone Formation is anticipated to underlie most of the Corridor, apart from a small parcel of land in the north-west and south-west corner.</p> <p>Penarth Group (Rhaetian): The north-west corner, south-west corner and the Redcar Mudstone</p>

SITE	ARTIFICIAL GEOLOGY (MADE GROUND)	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
		<p>Glaciolacustrine Deposits: It is anticipated that Glaciolacustrine Deposits will underlie the Tidal Flat Deposits.</p> <p>Till, Devensian: It is anticipated that Glacial Till Deposits will underlie the Glaciolacustrine Deposits.</p>	<p>Formation are anticipated to be underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (New Red Sandstone Supergroup): The Mercia Mudstone Group is anticipated to underlie a small parcel of land in the north-west corner and the Penarth Group.</p>
Electrical Connection Corridor	Present – most of the Corridor, apart from small parcels of land in the north-west and along eastern boundary.	<p>Blown Sand: It is anticipated that a thin strip of land along the eastern boundary will be underlain by Blown Sand Deposits.</p> <p>Tidal Flat Deposits: The remainder of the Corridor and the Blown Sand Deposits are anticipated to be underlain by Tidal Flat Deposits.</p> <p>Glaciolacustrine Deposits: It is anticipated that Glaciolacustrine Deposits will underlie the Tidal Flat Deposits.</p> <p>Till, Devensian: It is anticipated that Glacial Till Deposits will underlie the Glaciolacustrine Deposits.</p>	<p>Redcar Mudstone Formation (Lower Lias): The Redcar Mudstone Formation is anticipated to underlie most of the Corridor, apart from a small parcel of land in the north-west and far south-west corner.</p> <p>Penarth Group (Rhaetian): The north-west corner, south-west corner and the Redcar Mudstone Formation are anticipated to be underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (New Red Sandstone Supergroup): The Mercia Mudstone Group is anticipated to a small parcel of land in the north-west corner and underlie the Penarth Group.</p>
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: It is anticipated that a thin strip of land in the north-eastern extent of the Corridor to the east of the river Tees will be underlain by Blown Sand.	<p>Redcar Mudstone Formation (Lower Lias): The eastern and south-eastern extent (east of the river Tees) is underlain by the Redcar Mudstone Formation.</p> <p>Penarth Group (Rhaetian): The western and south-western extent (east of the river Tees) and the</p>

SITE	ARTIFICIAL GEOLOGY (MADE GROUND)	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
		<p>Peat: A small area of Peat encroaches on the central extent of the Corridor (west of the river Tees).</p> <p>Alluvium: Alluvium Deposits are anticipated to underlie the far north-western extent of the Corridor (west of the river Tees).</p> <p>Tidal Flat Deposits: The Blown Sand Deposits, Peat Deposits, the north-eastern extent (east of the river Tees) and central extent (west of the river Tees) as well as small parcels of land in the far western extent are anticipated to be underlain by Tidal Flat Deposits.</p> <p>Glaciolacustrine Deposits: The south-eastern extent (east of the river Tees) and south-western extent (west of the river Tees), and the Tidal Flat Deposits are anticipated to be underlain by Glaciolacustrine Deposits.</p> <p>Till, Devensian: The far south-western extent (east of the river Tees) and the Glaciolacustrine Deposits are anticipated to be underlain by Glacial Till Deposits.</p>	<p>Redcar Mudstone Formation is underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (New Red Sandstone Supergroup): The far western and south-western extent (east of the river Tees), the eastern area (west of the river Tees) and the Penarth Group are anticipated to be underlain by the Mercia Mudstone Group.</p> <p>Sherwood Sandstone Group (New Red Sandstone Supergroup): The western extent (west of the river Tees) and the Mercia Mudstone Group is underlain by the Sherwood Sandstone Group.</p>
Other Gases Connection Corridor	Present – most of the Corridor, apart from a small parcel of land in the north-east corner.	Blown Sand: It is anticipated that Blown Sand will underlie a small parcel of land in the north-east corner of the Corridor.	Redcar Mudstone Formation (Lower Lias): The Redcar Mudstone Formation is anticipated to underlie most of the Corridor, apart from a small parcel of land in the north-west corner.

SITE	ARTIFICIAL GEOLOGY (MADE GROUND)	SUPERFICIAL GEOLOGY	BEDROCK GEOLOGY
		<p>Tidal Flat Deposits: The remainder of the Corridor and the Blown Sand Deposits are anticipated to be underlain by Tidal Flat Deposits.</p> <p>Glaciolacustrine Deposits: Based on the mapping it is expected that Glaciolacustrine Deposits will underlie the Tidal Flat Deposits.</p> <p>Till, Devensian: Based on the mapping it is expected that Glacial Till Deposits will underlie the Glaciolacustrine Deposits.</p>	<p>Penarth Group (Rhaetian): The north-west corner and the Redcar Mudstone Formation are anticipated to be underlain by the Penarth Group.</p> <p>Mercia Mudstone Group (New Red Sandstone Supergroup): The Mercia Mudstone Group is anticipated to underlie the Penarth Group.</p>

Geological Features and Minerals

- 10.4.9 There are no recorded RIGS or Locally Important Geological Sites on or within 1 km of the Proposed Development Site.
- 10.4.10 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.
- 10.4.11 In taking forward minerals development in the plan area, and particularly along the river corridor and the River Tees, 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.
- 10.4.12 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.
- 10.4.13 Anhydrite was formerly mined by ICI for use in the chemical industry at Billingham. Production ceased in 1971 and the mine closed in 1978 when the shaft was capped¹. The capped shaft is located approximately 160 m to the east of the Hydrogen Distribution Network Corridor at Haverton Hill.
- 10.4.14 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 the deep mine at Billingham (Stockton-on-Tees), although the mine has not been worked since 1971 and the shaft is capped.
- 10.4.15 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.
- 10.4.16 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

¹ Mindat (n.d.)

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 (Stockton-on-Tees, 2011a) 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.

10.4.17 Appendix C of the Tees Valley Joint Minerals (Stockton-on-Tees, 2011a) and Waste Core Strategy DPD (Stockton-on-Tees, 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.

10.4.18 Safeguarded marine dredged sand and gravel (shallow resources) are present locally at Tees Dock. Tees Dock is also identified as a Safeguarded Wharf. Billingham Reach Industrial Estate is identified as a Safeguarded Wharf.

Natural Ground Hazards

10.4.19 Groundsure GIS data was used to present the Natural Ground Hazards for the Proposed Development on Figures 10-18a to 10-18f (ES Volume II, EN070009/APP/6.3). A summary of the Natural Ground Hazards at the Main Site and associated Connection Corridors is presented in the Summary Report.

Hydrogeology

10.4.20 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).

10.4.21 Figure 10-12a to 10-12g and Figure 10-13a to 10-13g (ES Volume II, EN070009/APP/6.3) present the designated superficial and bedrock aquifers within the Proposed Development Site.

10.4.22 Figure 10-14a to 10-14g presents the Groundwater Vulnerability classification for the Proposed Development Site.

10.4.23 Figure 10-15 presents the Groundwater Source Protection Zones for the Proposed Development Site.

10.4.24 Figure 10-16 presents the Groundwater Abstractions location at and within 1 km of the Proposed Development Site.

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

- 10.4.26 It should be noted that the Tidal Flat Deposits are designated as two separate aquifers on the DEFRA Magic Maps (DEFRA, n.d.), 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 10-12a to 10-12b (ES Volume II, EN070009/APP/6.3). 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. This split is artificial and appears to relate to BGS 1:10,000 Sheet NZ52NE (Warrenby) not showing the full extent of the superficial geology at the Main Site and the artificial straight line shown on this mapping appears to be an artifact noting the extent of mapping undertaken by the BGS (NZ52NE (BGS, 2006)).
- 10.4.27 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. There are no Drinking Water Groundwater Safeguard Zone (SgZs) 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	<ul style="list-style-type: none"> • Secondary A • Unproductive • Secondary Undifferentiated 	<ul style="list-style-type: none"> • Tidal Flat Deposits – Sand and Silt (eastern half of the Main Site) • Glaciolacustrine Deposits (silt/clay) • Till and Tidal Flat Deposits – Sand, Silt and Clay (western half of the Main Site)
Bedrock Aquifer	<ul style="list-style-type: none"> • Secondary B • Secondary Undifferentiated / Secondary B • Secondary Undifferentiated • Principal Aquifer 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	High (Secondary Superficial)	-

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
Source Protection Zone	None within 1 km	-
CO ₂ Export Corridor		
Superficial Aquifer	<ul style="list-style-type: none"> • Secondary A • Secondary A • Secondary Undifferentiated • Unproductive 	<ul style="list-style-type: none"> • Tidal Flat Deposits – Sand and Silt • Blown Sand • Glacial Till • Glaciolacustrine Deposits - clay
Bedrock Aquifer	<ul style="list-style-type: none"> • Secondary B • Secondary Undifferentiated /B • Secondary Undifferentiated • Principal 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-
Natural Gas Connection Corridor		
Superficial Aquifer	<ul style="list-style-type: none"> • Secondary A • Secondary A • Secondary Undifferentiated • Unproductive 	<ul style="list-style-type: none"> • Tidal Flat Deposits – Sand and Silt • Blown Sand • Till • Glaciolacustrine Deposits - clay
Bedrock Aquifer	<ul style="list-style-type: none"> • Secondary B • Secondary Undifferentiated /B • Secondary Undifferentiated • Principal 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	High (Secondary Superficial)	-

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
Source Protection Zone	None within 1 km	-
Water Connection Corridor		
Superficial Aquifer	<ul style="list-style-type: none"> • Secondary A • Secondary A • Secondary Undifferentiated • Unproductive 	<ul style="list-style-type: none"> • Tidal Flat Deposits – Sand and Silt • Blown Sand • Till • Glaciolacustrine Deposits - clay
Bedrock Aquifer	<ul style="list-style-type: none"> • Secondary B • Secondary Undifferentiated /B • Secondary Undifferentiated • Principal 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Secondary A • Secondary A • Secondary Undifferentiated 	<ul style="list-style-type: none"> • Tidal Flat Deposits – Sand and Silt (north-eastern extent of the Corridor) • Blown Sand

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
	<ul style="list-style-type: none"> • Unproductive 	<ul style="list-style-type: none"> • Till and Tidal Flat Deposits – Sand, Silt and Clay (for north-western and southern extend of the Corridor) • Glaciolacustrine Deposits - clay
Bedrock Aquifer	<ul style="list-style-type: none"> • Secondary B • Secondary Undifferentiated /B • Secondary Undifferentiated • Principal 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	<ul style="list-style-type: none"> • High (Secondary Superficial) • Medium (Secondary Superficial) • Medium (Secondary Bedrock) • Low (Secondary Bedrock) 	-
Source Protection Zone	None within 1km	-
Hydrogen Pipeline Corridor		
Superficial Aquifer	<ul style="list-style-type: none"> • Secondary A • Secondary Undifferentiated • Unproductive 	<ul style="list-style-type: none"> • Tidal Flat Deposits – Sand and Silt (north-eastern extent of the Corridor) • Blown Sand • Alluvium • Till and Tidal Flat Deposits – Sand, Silt and Clay (north-west and south-west extent of the Corridor) • Glaciolacustrine Deposits-- clay
Bedrock Aquifer	<ul style="list-style-type: none"> • Secondary B 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group

RELEVANT HYDROGEOLOGICAL FEATURE	DESIGNATION	STRATA
	<ul style="list-style-type: none"> • Secondary Undifferentiated /B • Secondary Undifferentiated • Principal 	<ul style="list-style-type: none"> • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	<ul style="list-style-type: none"> • High (Secondary Superficial) • Medium (Secondary Superficial) • Medium (Secondary Bedrock) • Low (Secondary Bedrock) 	-
Source Protection Zone	None within 1 km	-
Other Gases Connection Corridor		
Superficial Aquifer	<ul style="list-style-type: none"> • Secondary A • Secondary A • Secondary A 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Secondary B • Secondary Undifferentiated /B • Secondary Undifferentiated • Principal 	<ul style="list-style-type: none"> • Mercia Mudstone • Penarth Group • Redcar Mudstone • Sherwood Sandstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-

Historical Development

- 10.4.28 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.
- 10.4.29 The historical development of the Proposed Development Site is discussed in detail in Appendix 10A (ES Volume III, EN070009/APP/6.4).
- 10.4.30 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;

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- 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.

10.4.31 Historical land uses are provided on the following figures (ES Volume II, EN070009/APP/6.3):

- Figure 10-6: Waste and Landfills;
- Figure 10-7: Hazardous Sites;
- Figure 10-8a to 10-8g: Historical Industrial Land Uses;
- Figure 10-9 Historical Tanks; and
- Figure 10-11: Discharge Consents.

Future Baseline

10.4.32 Future ground conditions on the Main Site may be improved relative to the existing baseline conditions, where existing made ground is remediated by STDC under a

separate planning application prior to commencement of the Proposed Development Site or by the Applicant pursuant to this DCO .

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 (also 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.

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. These have then been followed through the assessment to ensure that realistic likely environmental effects are identified.

10.5.3 The following impact avoidance measures have either been incorporated into the design or are standard construction or operational practices. These measures have, therefore, been taken into account during the impact assessment and will be secured through a Requirement of the Draft DCO (EN070009/APP/4.1).

Construction

10.5.4 The Framework Construction Environmental Management Plan (CEMP) (EN070009/APP/5.12) sets out the key measures to be employed during the construction of the Proposed Development, to control and minimise the impacts on the environment. The Framework CEMP will set out how impacts upon geology, hydrogeology and contaminated land will be managed during construction. The Final CEMP(s) 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(s) will be secured by a Requirement of the Draft DCO (EN070009/APP/4.1).

10.5.5 In order to manage and monitor waste generated on the Proposed Development Site during construction, an Outline Site Waste Management Plan (SWMP) has been 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 Outline 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 Proposed Development Site will be undertaken by fully licensed waste carriers and taken to permitted waste facilities. In addition, the Final CEMP(s) will also include a Material Management Plan (MMP) following guidance in DoWCoP (CL:AIRE, 2011) and a Hazardous Materials Management Plan including an Asbestos Management Plan (AMP). It is envisaged that a Deposit for Recovery Permit will be obtained to allow specifically itemised volumes of made ground materials which will be excavated at the Main Site to be recovered.

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- 10.5.6 Rainfall runoff from areas where there is a risk of contamination will be managed using temporary drainage systems and or tankered offsite for treatment (including settlement of suspended solids and or oil interceptors) prior to discharge to local watercourses with the approval of the Environment Agency pursuant to a discharge licence. The drainage systems will incorporate pollution control systems designed in line with the Control of Water Pollution from Construction Sites – Guidance for consultants and contractors C532 (CIRIA, 2001) or as agreed with the relevant authorities. Surface watercourses and waterbodies near worksites will be regularly inspected for signs of siltation or other forms of pollution in line with CIRIA Environmental Good Practice on Site Guide C741 (CIRIA, 2015), whilst pumped groundwater, process effluents and construction site runoff will be tested to ensure compliance with discharge consent requirements – these measures are detailed in the Framework CEMP (Volume III, EN070009/APP/6.4) and will be set out in the Final CEMP(s).
- 10.5.7 Rainfall runoff from areas of low contamination risk will be captured and stored in settlement ponds for reuse where reasonably practicable to reduce consumptive water use (e.g. to supply wheel wash facilities or for dust suppression).
- 10.5.8 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, confirmatory GI will be undertaken which will include assessing whether and to what extent contamination is present at the Main Site. 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 British Standards Institute (BSI) BS EN 1997-2:2007 (BSI, 2007), BS5930:2015+A1:2020 (BSI, 2020) and BS10175:2011+A2:2017 (BSI, 2017). GI will also be undertaken as required, dependant on the depth of construction, where below ground works are to be completed along the Connection Corridors. This is secured under a Requirement of the Draft DCO (EN070009/APP/4.1).
- 10.5.9 The GI findings will feed into the detailed design process so that appropriate measures can be taken. Specific measures include 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.
- 10.5.10 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 (2023). The significance of impacts will take into account the principles of assessment identified in CIRIA Report C552, (CIRIA, 2001) and EAs guiding principles for land contamination in assessing risks to controlled
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- waters (EA, 2010). Any such risk-based assessment may indicate the need for mitigation measures additional to those as detailed herein.
- 10.5.11 STDC are currently completing site clearance in central and southern areas of the Main Site and impacts from this activity have not been included in this assessment.
- 10.5.12 It is currently anticipated that STDC will complete remediation works required to create a suitable development area before the Applicant's commencement of the construction of the Proposed Development. The scope of STDCs remedial works will include mitigation of any identified risks to controlled waters and / or human health, with STDC to obtain all necessary consents and permits for the works.
- 10.5.13 In particular, the Applicant understands that STDC are to submit reserved matters approval applications for remedial works in central and southern areas of the Main Site, under their existing outline planning approval for the Foundry site. It is currently anticipated that STDC would submit additional reserved matters approval, or planning applications, for further site clearance and remedial works, if the Applicant proposed construction in the north-west or north-east of Main Site for Phase 2 of the Proposed Development, in accordance with STDCs stated aim to redevelop and regenerate the larger South Tees Development Corporation (STDC) site. If, for any reason, STDC do not bring forward these reserved matters planning applications, or the remediation works are not undertaken in the timescales required, the Applicant would undertake remedial activities required for the development, and this has been assumed as a worst-case assumption for the purposes of the ES. As such, references to start of construction in this ES should be considered to include such works.
- 10.5.14 The Applicant will also review the scope of any remedial measures considered to be required following the completion of (referred to herein as 'Additional'), or in place of, the remedial works undertaken by STDC. Additional remedial measures before or during construction, could include measures such as a discovery strategy for unexpected contamination, and will be reviewed following review of both GI and relevant remediation specifications and verification reports from STDC. The process for securing the delivery of these remedial measures including the Additional measures is secured by DCO Requirement.
- 10.5.15 Estimates of waste from the Proposed Development Site in Chapter 21: Materials and Waste Management (ES Volume I, EN070009/APP/6.2), conservatively assume that some hazardous and non-hazardous material generated during any Applicant remediation works before or during construction activities, could require disposal from the Proposed Development Site, with recovery of some soil materials under appropriate permitting. The volumes assume that stockpiled made ground materials specifically included within a Deposit for Recovery Permit are able to be recovered, and do not require disposal. The volume estimates will be further refined following both GI and relevant remediation specifications and verification reports from STDC (if taken forward by them) but it is not anticipated that there would be significant changes that would materially increase the HGV movements required.
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- 10.5.16 If piling is required, a piling risk assessment will be carried out 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' Aquifers. 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 considering the scope of STDC remedial works and any remediation measures proposed by the Applicant, this is secured pursuant to a Requirement of the Draft DCO (EN070009/APP/4.1).
- 10.5.17 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, pursuant to DCO Requirement. The contamination assessment will be conducted in accordance with CIRIA C552 - Contamination Land Risk Assessment, A Guide to Good Practice and Land Contamination: Risk Management (EA, 2023). Any required remedial measures will be adopted as part of the Proposed Development Site.
- 10.5.18 The Proposed Development Site design is actively working towards a net cut and fill balance of zero. The suitability of excavated materials for potential recovery, and / or any permitting required to recover excavated materials, will be assessed following confirmatory GI works, and with consideration to STDC remedial works. **It is envisaged that a Deposit for Recovery Permit will be obtained to allow specifically itemised volumes made ground materials which will be excavated at the Main Site to be recovered.** All earthwork operations will need to be undertaken in accordance with BS6031:2009 (BSI, 2009) and applicable guidelines, including the Manual for Contract Documents for Highway Works (MCHW) Series 600 'Earthworks' (National Highways, 2017).
- 10.5.19 Construction phase mitigation measures in relation to the geological and hydrogeological environment are summarised here and presented in the Framework Construction Environmental Management Plan (EN070009/APP/5.12):
- 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 Framework CEMP. Such measures are set out in the Framework CEMP (EN070009/APP/5.12). The Final CEMP(s) will address the management of concrete batching, concrete usage and accidental spillage relating to foundation and building construction.
 - Soil resources will be protected and conserved where possible through adherence to best practice guidance such as DEFRA's 2009 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' (DEFRA, 2009).

- An AMP will be required prior to the start of construction as part of the Final CEMP(s). Particular emphasis is placed on this with regards to the development of the Main Site.
- 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 to a minimum of 8m from the top of the bank of a main river or 16m for a tidal main river, impermeable liners and bunds will 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 Final CEMP(s) and consultation with the EA will take place before construction commences.

10.5.20 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 Final CEMP(s), 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.

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- 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 (HM Government, 2001) and Control of Substance Hazardous to Health (COSHH) Regulations 2002 (Health and Safety Executive, 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 Final CEMP(s) 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 Main Site 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 (HM Government, 1991a) 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 Environmental Permitting Regulations 2019 (HM Government, 2019) not to 'cause or knowingly permit' a water discharge activity or groundwater activity without an environmental permit.
 - Reference should also be made to the controlled water mitigation measures as detailed in Chapter 9: Surface Water, Flood Risk and Water Resource (ES Volume I, EN070009/APP/6.2).
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10.5.21 The H2Teesside project considers the use of trenchless techniques, including Horizontal Directional Drilling (HDD), for major crossings beneath the Teesmouth and SPA and Ramsar site to be a form of mitigation against habitat loss. However, it is noted the potential also exists for habitat loss to occur as a result of HDD collapse or leakage of drilling fluid to the surface, known as breakout. There are standard measures which are included in the design and performance of the HDD which are considered sufficient to avoid the risk of habitat loss. These include:

- Before drilling:
 - Undertaking a ground investigation
 - Detailed design of the launch point or landfill of the HDD, showing geological layers and the intended drill path which has sufficient depth below surface for the expected ground conditions to minimise risk of failure/collapse
 - Undertaking a hydraulic fracture analysis
- During drilling:
 - Ensure drilling fluid is of sufficient viscosity and properties for the ground being drilled
 - Have lost circulation cleanup materials on site to seal any breakout
 - Use casing through weaker cohesive layers near the ground surface if necessary
 - Removal of poor ground / ground stabilisation prior to drilling
 - Monitoring of drilling fluid returns and volumes during drilling to warn of inadequate hole cleaning
 - Monitoring downhole annular pressure (set by fracture analysis) in real time to warn of over pressurising by drilling fluid

10.5.22 In addition the H2Teesside framework CEMP includes[*] the following commitments:

- A commitment to producing a Code of Construction Practice which would specify measures designed to minimise the risk of collapse of any HDD crossing;
- A requirement for the contractor's drilling method statement to form the basis of contingency plans which provide details of specific clean-up and pollution control measures which would be used in the event of an accidental spillage.
- Natural England, and any landowner of land crossed by the HDD, would be consulted on the effectiveness of the proposed measures in reducing effects on designated sites; and
- A requirement for the contractor's drilling method statement to include pollution prevention measures that would be used to minimise the risk of accidental spillage.

Operation

- 10.5.23 The Hydrogen Production Facility will require an Environmental Permit and will comply with this under the Environmental Permitting (England and Wales) Regulations 2016 (HM Government, 2016).
- 10.5.24 Prevention of contamination will be 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. The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024.
- 10.5.25 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 attested 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.
- 10.5.26 An Indicative Surface Water Drainage Plan has been produced for the DCO Application (EN070009/APP/2.12), which details the operational drainage systems to be implemented to control potential impacts from pollution to surface watercourses.
- 10.5.27 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 to comply with industry best practice;
 - the storage and handling of processed chemicals will be undertaken in properly surfaced and bunded areas depending on the findings of the risk assessment that would support the environment permit application and permit conditions set by the regulator;
 - implementation of rapid spill response planning and training depending on the findings of the risk assessment that would support the environment permit application and permit conditions set by the regulator; and
 - the preparation of a groundwater quality monitoring plan depending on the findings of the controlled waters risk assessment (to be undertaken based on ground investigation data) that would support the environment permit application and permit conditions set by the regulator.

The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024.

Decommissioning

- 10.5.28 A Decommissioning Environmental Management Plan (DEMP) would be produced pursuant to a DCO Requirement. The DEMP would consider in detail all potential
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- environmental risks on the Proposed Development Site and contain guidance on how risks can be removed or mitigated. This will include details of how geology, hydrogeology and contaminated land should be managed during decommissioning and demolition. The DEMP would be secured by a Requirement of the Draft DCO (EN070009/APP/4.1).
- 10.5.29 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.
- 10.5.30 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.
- 10.5.31 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.
- 10.5.32 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 as part of the DEMP.
- 10.5.33 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 Impacts and Likely Significant Effects
- 10.6.1 The Proposed Development and the Connection Corridors have the potential to cause adverse effects to the geology, hydrogeology and contaminated land during construction and operation phases in the absence of impact avoidance measures described in Section 10.5.
- 10.6.2 The majority 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 the construction works.
- 10.6.3 Table 10-11 summarises the resource value (sensitivity) of the identified receptors within the Proposed Development Site.
- 10.6.4 A summary of effects during Proposed Development Site construction, operation and decommissioning (taking into account the mitigation measures) is presented in Table 10-12. Where the significance of effects are considered to be not significant (inclusive of embedded mitigation), further mitigation is recommended in the form of GI to confirm assessment.
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Table 10-11: Resource Value (Sensitivity)

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
Geology – See Figure 10-3a to 10-3g – 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 (Anhydrite)	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

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
				<p>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 deep mine at Billingham (Stockton-on-Tees) although the mine has not been worked since 1971 and the shaft was capped in 1978.</p>
Soils – See Figure 10-19a to 10-19g - 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 Hydrogen Pipeline Corridor Other Gases Connection Corridor	Low	Soils are recorded as non-agricultural/urban.

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
Soils (ALC)	Agricultural Land Value (measured using the ALC)	Hydrogen Pipeline Corridor	Grade 3 – High	Areas of Grade 3 soil are located in the western extent of the Hydrogen Pipeline Corridor north of the River Tees (Cowpen Bewley Replacement Land). The land is not subdivided into Grade 3a or 3b, therefore, a worst-case assessment assuming Grade 3a land has been adopted.
Soils (ALC)	Agricultural Land Value (measured using the ALC)	Hydrogen Pipeline Corridor	Grade 5 – Low Grade 4 – Low	Areas of Grade 4 (Poor) and 5 (Very Poor) north of the River Tees.
Soils – See Figure 10-1a to 10-1g – Artificial Geology and 10-2a to 10-2g – Superficial Geology				
Soils	Blown Sand	CO ₂ Export Corridor Natural Gas Connection Corridor Water Connection Corridor Electrical Connection Corridor Hydrogen Pipeline Corridor Other Gases Connection Corridor	High	Soils in sensitive environmental designations (Teessmouth and Cleveland Coast SPA, Ramsar Site and SSSI).

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
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 Glaciofluvial Deposits – Sand and Gravel Alluvium	Entirety of the Proposed Development Site	Low	Soils supporting non-designated notable or priority habitats.
Groundwater – See Figure 10-13a to 10-13g – 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

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
				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.
Groundwater – See Figure 10-12a to 10-12g 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	High	Area is outside of any designated SPZ. Secondary Aquifer – A.

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
		Electrical Connection Corridor Hydrogen Connection Corridor		
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 Glaciofluvial Deposits – Sand and Gravel Alluvium	Entirety of the Proposed Development Site	Low	Area is outside of any designated SPZ. Unproductive Strata.
Contamination (Soils)				
Contamination (Soils)	Blown Sand Tidal Flat Deposits – Sand and Silt	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

ASPECT/ CRITERIA	RESOURCE/ RECEPTOR	PART OF THE PROPOSED DEVELOPMENT SITE	RESOURCE VALUE/ SENSITIVITY	JUSTIFICATION
	Tidal Flat Deposits – Sand, Silt and Clay Till, Devensian – Diamicton Glaciolacustrine Deposits, Clay and Silt. Glaciofluvial Deposits, Sand and Gravel. Glacial Till, Devensian – Diamicton			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 for the Proposed Development Site

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Construction				
Geology Sherwood Sandstone Group – Sandstone	Sherwood Sandstone Group – Sandstone: Medium	Minor (From Foundations, e.g. creation of new contaminant linkages (e.g. pile foundation construction through existing Made Ground into underlying natural soils or bedrock,	Sherwood Sandstone Group – Sandstone: Slight Adverse (Not Significant) Mercia Mudstone Group - Mudstone, Penarth Group – Mudstone and Redcar	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Mercia Mudstone Group - Mudstone Penarth Group – Mudstone Redcar Mudstone Formation - Mudstone	Mercia Mudstone Group - Mudstone, Penarth Group – Mudstone and Redcar Mudstone Formation – Mudstone: Low	pile foundation construction or excavation through an existing aquiclude (impermeable fine / cohesive soils) into an aquifer (comprised of coarse or sandy soils)) Main Site	Mudstone Formation – Mudstone: Slight Adverse (Not Significant)	
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) Hydrogen Pipeline Corridor	Slight Adverse (Not Significant)	T
Minerals Deep Resources Salt and Gypsum	Medium	Minor (from sterilisation of minerals. Non-minerals developments take place on, or close to, mineral deposits	Slight Adverse (Not Significant)	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
		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) Proposed Development Site		
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) Proposed Development Site	Slight Adverse (Not Significant)	T
Soils Agricultural Land Classification	Low	Negligible (From extraction / removal of soils) Proposed Development Site	Slight Adverse (Not Significant)	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Soils Agricultural Land Classification	High	Not Discernible (From extraction / removal of soils – Physical removal or permanent sealing of <1ha of agricultural land is reported as not discernible based on LA109) Hydrogen Pipeline Corridor	N/A	P
Soils General	Medium	Minor (From spoil resulting from excavations and earthworks) Proposed Development Site	Slight Adverse (Not Significant)	T
Groundwater (Bedrock Contamination) Principal Aquifer Sherwood Sandstone	High	Minor (from changes to hydrogeological regime due to potential mobilisation of any existing contamination during construction) Proposed Development Site	Slight Adverse (Not Significant)	P/T
Groundwater (Bedrock Contamination) Secondary Aquifer	Medium	Minor (from changes to hydrogeological regime due to potential mobilisation of any existing contamination during construction)	Slight Adverse (Not Significant)	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
<p>– B Mercia Mudstone Group – Mudstone and Penarth Group – Mudstone</p> <p>Secondary Undifferentiated Redcar Mudstone Formation – Mudstone</p>		<p>Proposed Development Site</p>		
<p>Groundwater – (Soil Contamination) Secondary Aquifer – A Blown Sand</p> <p>Beach and Tidal Flat Deposits</p>	<p>Medium</p>	<p>Minor (from potential mobilisation of any potential existing contamination 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)</p> <p>Proposed Development Site</p>	<p>Slight Adverse (Not Significant)</p>	<p>T</p>

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
<p>Groundwater – (Soil Contamination) Secondary Aquifer – Undifferentiated</p> <p>Tidal Flat Deposits – Sand and Silt</p> <p>Tidal Flat Deposits – Sand, Silt and Clay</p>	Medium	<p>Minor (from potential mobilisation of any existing contamination during construction. New contaminant pathways or mobilisation of existing contaminants may result from exposure of soils/increases in rainwater infiltration through changes in ground cover/in excavations)</p> <p>Proposed Development Site</p>	Slight Adverse (Not Significant)	T
<p>Contamination (Soils)</p> <p>Blown Sand Tidal Flat Deposits</p>	High	<p>Minor (potential contaminant pathways may be reduced or removed by remedial works including clean cover or capping layer as well as through construction of new structures, hardstanding, pavements over existing contaminated soils. Infiltration pathways may be reduced).</p>	Slight Beneficial (Not Significant)	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
		Main Site		
Contamination (Soils) Blown Sand Tidal Flat Deposits - Sand and Silt Tidal Flat Deposits – Sand, Silt and Clay Glaciolacustrine Deposits, Clay and Silt. Glaciofluvial Deposits, Sand and Gravel.	Low	Minor (potential contaminant pathways may be reduced or removed by remedial works including clean cover or capping layer as well as through construction of new structures, hardstanding, pavements over existing contaminated soils. Infiltration pathways may be reduced). Main Site	Slight Beneficial (Not Significant)	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Glacial Till, Devensian – Diamicton				
Operational				
Contamination (Soils) Blown Sand Tidal Flat Deposits	High	Minor (from impacts on soil quality which could potentially occur during operation caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids) Proposed Development Site	Slight Adverse (Not Significant)	P
Groundwater (Bedrock Contamination) Principal Aquifer Secondary B Aquifers	Medium / High	Minor (Impacts on groundwater could potentially occur during operation caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids) Proposed Development Site	Slight Adverse (Not Significant)	P

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Secondary Undifferentiated				
Decommissioning				
Contamination (Soils)	Medium	Minor (from excavation of materials/soil removal. Demolition workers exposed to historic and current potentially contaminated soil sources on Site) Proposed Development Site	Slight Adverse (Not Significant)	T
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) Proposed Development Site	Slight Adverse (Not Significant)	T

RESOURCE/ RECEPTOR	VALUE/ SENSITIVITY	MAGNITUDE OF IMPACT	SIGNIFICANCE OF EFFECT (WITH EMBEDDED MITIGATION)	NATURE OF EFFECT (PERMANENT OR TEMPORARY)
Groundwater (Bedrock Contamination) Principal Aquifer Secondary A Secondary Undifferentiated	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 chemicals and processed liquids) Proposed Development Site	Slight Adverse (Not Significant)	T
Soils (General)	Medium	Minor (from export, excavation, stockpiling, redistribution and / or removal of the Made Ground) Main Site	Slight Adverse (Not Significant)	T

Note: P = permanent, T = temporary

Construction

- 10.6.5 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 foundations, strip and pad footings), earthworks and excavations (foundations and service conduits).
- 10.6.6 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.
- 10.6.7 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 potential mobilisation of any existing contamination 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;
 - 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.
- 10.6.8 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 (ES Volume I, EN070009/APP/6.2).
- 10.6.9 There may also be beneficial effects if any previously unidentified contaminated soil is identified and remediated.

Geology

- 10.6.10 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.

10.6.11 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

10.6.12 Mineral resources are present at depth below the Proposed Development Site and are already primarily covered by existing industrial development at the Main Site. The mineral resources at Proposed Development Site would not be sterilised by the development or render the sites inaccessible for future use.

10.6.13 As indicated in Table 10-12, 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

10.6.14 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 Adverse (Not Significant) effects.

10.6.15 Presumed Grade 3a soils at the Cowpen Bewley Replacement Land have been classed as High value. However, the works are anticipated to be minor and may include tree planting to create open space and join it up with the existing woodland park. It is not expected that there will be physical removal or permanent sealing of agricultural land. However, the assessment has allowed for a conservative <1ha removal or permanent sealing. Based on DMRB LA109 (National Highways, 2019a), physical removal or permanent sealing of <1ha of agricultural land should be reported as not discernible. Therefore, a significance of effect is not applicable.

10.6.16 Soils would be stockpiled for re-use onsite where possible.

Hydrogeology – Changes to Hydrogeological Regime

10.6.17 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 effect to Proposed Development Site is considered to be Slight Adverse (Not Significant) following the implementation of development design and impact avoidance mitigation as detailed in Section 10.5.

10.6.18 With appropriate design of Proposed Development Site construction activities and the implementation of the measures included in the Framework CEMP as described in Section 10.5, it is anticipated that impacts would be no worse than Minor, resulting in effects no greater than Slight Adverse (Not Significant).

Controlled Waters – Contamination

10.6.19 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 Principal, Secondary 'A' Aquifers, Secondary 'B' and Secondary Undifferentiated 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 effect of the Proposed Development Site is considered to be Slight Adverse (Not Significant) following the implementation of development design and impact avoidance mitigation as detailed in Section 10.5.
- 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 effect of the Proposed Development Site is considered to be Slight Adverse (Not Significant) following the implementation of development design and impact avoidance mitigation as detailed in Section 10.5.
- 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 effect of the Proposed Development Site is considered to be Slight Adverse (Not Significant) following the implementation of development design and impact avoidance mitigation as detailed in Section 10.5. Furthermore, a Piling Risk Assessment will be undertaken to mitigate the risks from foundation construction.
- Creation of new potential contaminant linkages or potential mobilisation of any existing contamination may result from exposure of soils / increases in rainwater infiltration through changes in ground cover / in excavations or bulk earthworks. The potential effect of the Proposed Development Site is considered to be Slight Adverse (Not Significant) following the implementation of development design and impact avoidance mitigation as detailed in Section 10.5.
- 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.

10.6.20 All works must comply with a Water Management Plan as well as any abstraction/ discharge permits required pursuant of the Environmental Permitting Regulations (2016). The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024. An Outline Water

Management Plan is presented as part of the Framework CEMP (EN070009/APP/5.12) and updated prior to construction as part of the Final CEMP(s). With appropriate design of the Proposed Development Site construction activities and the implementation of the measures included in the Final CEMP(s), it is anticipated that effects would be no worse than Minor, resulting in effects no more than Slight Adverse (Not Significant).

Soils – Contamination

- 10.6.21 Remediation of potentially contaminated soils has the potential to have a beneficial significance of effect as potential contaminant pathways are reduced 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 can also be reduced. The magnitude of impact to the reduced or removal of contaminated soils is considered to be Minor with a Slight Beneficial (Not Significant) effect.

Operation

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

- 10.6.23 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 effects of the Proposed Development Site is considered to be Slight Adverse (Not Significant).

- 10.6.24 Environmental Permit will be required for the operation of the Proposed Development Site. The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024. With appropriate operational management of the Proposed Development Site in accordance with the Environmental Permit, it is anticipated that impacts would be Minor, resulting in effects no more than Slight Adverse (Not Significant).

Decommissioning

- 10.6.25 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.

- 10.6.26 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.

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

10.7 Essential Mitigation and Enhancement Measures

10.7.1 Section 10.6 indicates that with the implementation of the proposed development design and impact avoidance measures (embedded mitigation) 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.

Construction

10.7.2 No further measures are considered for the construction phase outside of the Proposed Development Design and Impact Avoidance / Embedded Mitigation.

Operation

10.7.3 No further measures are considered for the Operation Phase outside of the Proposed Development Design and Impact Avoidance / Embedded Mitigation.

Decommissioning

10.7.4 No further measures are considered for the Decommissioning Phase outside of the Proposed Development Design and Impact Avoidance / Embedded Mitigation.

10.8 Residual Effects and Conclusions

10.8.1 The effects of the Proposed Development Site following the implementation of essential mitigation and enhancement measures are known as 'residual effects.' No additional essential mitigation and enhancement measures have been identified outside of the proposed development design and impact avoidance embedded mitigation measures. Therefore, the residual effects are considered the same and range between Slight Beneficial (Not Significant) and Slight Adverse (Not Significant) for the Proposed Development Site during the construction, operation (including maintenance) and decommissioning phases as presented in Tables 10-15, 10-16 and 10-17 respectively.

10.9 Summary of Residual Effects

10.9.1 There are not considered to be any residual significant effects associated with the construction, operation and decommissioning of the Proposed Development. A summary of the residual effects are presented in Tables 10-13, 10-14 and 10-15 respectively.

Table 10-13: Summary of Residual Effects During Construction

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
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: Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
Geology Mercia Mudstone Group - Mudstone	Low	Minor (From Directional drilling through mudstones to form crossing below the river Tees. Spoil generated from construction)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Penarth Group – Mudstone Redcar Mudstone Formation -				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 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)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation). 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)
Minerals Shallow Resources	Medium	Minor (Safeguarded under the Tees Valley Joint Minerals and Waste Development	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Marine dredge Sand and Gravel		Minerals and Waste Core Strategy DPD)		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.	(Not Significant)
Soils Agricultural Land Classification	Low	Negligible (From extraction / removal)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
Soils Agricultural Land Classification	High	Not Discernible (From extraction / removal/physical sealing)	N/A	N/A	N/A
Soils General	Medium	Minor (From spoil resulting from excavations and earthworks)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
Groundwater (Bedrock Contamination)	High	Minor (from changes to hydrogeological regime. Potential mobilisation of any existing contamination during construction)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation). Construction of piled foundations or deep excavations resulting in disturbance of the	Slight Adverse (Not Significant)

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Principal Aquifer Sherwood Sandstone				Sherwood Sandstone are not anticipated over the length of the Hydrogen Pipeline Corridor.	
Groundwater (Bedrock Contamination) Secondary Aquifer – B Mercia Mudstone Group – Mudstone and Penarth Group – Mudstone Secondary Undifferentiated Redcar Mudstone Formation – Mudstone	Medium	Minor (from changes to hydrogeological regime. Potential mobilisation of any existing contamination during construction)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Groundwater – (Soil Contamination) Secondary Aquifer – A Blown Sand Beach and Tidal Flat Deposits	Medium	Minor (from potential mobilisation of any existing contamination 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)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
Groundwater – (Soil Contamination) Secondary Aquifer – Undifferentiated Tidal Flat Deposits – Sand and Silt	Medium	Minor (from potential mobilisation of any existing contamination during construction. New contaminant pathways or mobilisation of existing contaminants may result from exposure of soils/increases in rainwater infiltration through changes	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Tidal Flat Deposits – Sand, Silt and Clay		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, pavements over existing contaminated soils. Infiltration and pathways are reduced)	Slight Beneficial (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation). Note DMRB LA104 (National Highways, 2019c), 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.	Slight Beneficial (Not Significant)
Contamination (Soils) Blown Sand Tidal Flat Deposits	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	Slight Beneficial (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation). Note DMRB LA 104 (National Highways, 2019c) does not include for a magnitude category 'Beneficial' category. However, any remedial works	Slight Beneficial (Not Significant)

RECEPTOR/ RESOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
<p>- Sand and Silt</p> <p>Tidal Flat Deposits – Sand, Silt and Clay</p> <p>Glaciolacustrine Deposits, Clay and Silt.</p> <p>Glaciofluvial Deposits, Sand and Gravel.</p> <p>Glacial Till, Devensian – Diamicton</p>		<p>structures, hardstanding, pavements over existing contaminated soils. Infiltration and pathways are reduced)</p>		<p>such as placement of clean cover, soil treatment, soil stabilisation, removal of localised ‘hotspots’ of identified contamination would provide improvement to the existing condition.</p>	

Table 10-14: Summary of Residual Effects During Operation

RECEPTOR/ RECOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
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 Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
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 Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)

Table 10-15: Summary of Residual Effects During Decommissioning

RECEPTOR/ RECOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Contamination (Soils)	Medium	Minor (from excavation of materials/soil removal Demolition workers exposed to historic and current potentially contaminated soil sources on Site)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
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)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)
Groundwater (Bedrock Contamination) Principal Aquifer Secondary A Secondary Undifferentiated	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 chemicals and processed liquids)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)

RECEPTOR/ RECOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	ADDITIONAL MITIGATION / ENHANCEMENT MEASURES	RESIDUAL EFFECTS
Soils (General)	Medium	Minor (from export, excavation, stockpiling, redistribution and / or removal of the Made Ground)	Slight Adverse (Not Significant)	No additional mitigation measures required outside of proposed development design and impact avoidance (embedded mitigation).	Slight Adverse (Not Significant)

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