13. Agriculture and Soil Resources

13.1 Introduction

13.1.1 This chapter presents the preliminary assessment of the likely significant effects of the Project with respect to agriculture and soil resources, including peat. The preliminary assessment is based on information obtained to date. It should be read in conjunction with the Project description provided in **Chapter 2: The Project** and with respect to relevant parts of the following chapters:

- **Chapter 5: Biodiversity**;
- **Chapter 6**: **Historic Environment**;
- **Chapter 7: Water Environment**;
- **Chapter 12: Ground Conditions**;
- **Chapter 15: People and Communities**; and
- **Chapter 17: Climate Change and Greenhouse Gases**

13.1.2 This chapter describes:

- the legislation, policy and technical guidance that has informed the assessment (**Section 13.2**);
- consultation and engagement that has been undertaken to date and how comments from consultees relating to agriculture and soil resources have been addressed (**Section 13.3**);
- a description of the study area (**Section 13.4**);
- the methods used for baseline data gathering (**Section 13.5**);
- overall baseline (**Section 13.6**);
- embedded environmental measures relevant to agriculture and soil resources (**Section 13.7**);
- the scope of the assessment for agriculture and soil resources (**Section 13.8**);
- the methodology applied for the assessment (**Section 13.9**);
- the preliminary assessment of agriculture and soil resources effects (**Section 13.10**);
- a summary of the preliminary significance conclusions (**Section 13.11**);
- an outline of further work to be undertaken for the Environmental Statement (ES) (**Section 13.12**).

Limitations and assumptions

13.1.3 The information provided in this Preliminary Environmental Information Report (PEIR) demonstrates the results of initial analysis, the final assessment of likely

significant effects will be reported in the ES. The PEIR has been produced to fulfil the Applicant's consultation duties and enable consultees to develop an informed view of the likely significant effects of the Project.

13.1.4 The assessment is based predominantly on available desk-based information on the baseline soil and agricultural land conditions, and the extent, depth and thickness of peat deposits within the Preliminary Order Limits. The baseline information will be updated based upon the findings of ground investigation surveys including targeted investigation of identified peat areas to be completed prior to the ES.

13.2 Relevant legislation, planning policy and technical guidance

13.2.1 This section identifies the legislation, planning policy and technical guidance that has informed the assessment of effects with respect to agriculture and soil resources. Further information on policies relevant to the Project is provided in **Chapter 4: Legislation and policy overview**.

Legislation

13.2.2 A summary of the relevant legislation is given in **Table 13.1**.

Table 13.1 Legislation relevant to the agriculture and soil resources assessment

Legislation	Legislative context
The Infrastructure (Environmental Impact Assessment) Regulations 2017	The EIA Regulations 2017 require that during screening of projects the planning authority and the Applicant must provide a description of any likely significant effects of the proposed development on the environment, including those resulting from *'the use of natural resources, in particular soil, land, water and biodiversity'* (Schedule 3 Selection Criteria for Screening Schedule 2 Development) requires that: 2.(1) *'The environmental sensitivity of geographical areas likely to be affected by development must be considered, with particular regard, to—* *(a) the existing and approved land use;* *(b) the relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground.'* In Schedule 4 Information for Inclusion in Environmental Statements, the description of the development is to include: 1.(d) *'an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced during the construction and operation phases.'*
The Environment Act 2021[1]	The Environment Act 2021 passed into law in November 2021. It provides a framework and the legal basis for the establishment of the Office for Environmental Protection (OEP) but many of the associated targets, policies and regulations are yet to be established. The Environment Act 2021 requires organisations to pay regard to environmental principles including:

[1] UK Government (2021). Environment Act 2021. (Online). Available at: https://bills.parliament.uk/bills/2593 (Accessed November 2021).

Legislation	Legislative context
	• The prevention principle, which means that government policy should aim to prevent, reduce or mitigate harm • The rectification at source principle, which means that if damage to the environment cannot be prevented it should be tackled at its origin • The polluter pays principle, which is the principle that those who cause pollution or damage to the environment should be responsible for mitigation or compensation • The precautionary principle, which states that where there are threats of serious or irreversible environmental damage, a lack of scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation The Environment Act 2021 also strengthens woodland protection enforcement measures and biodiversity protection and includes a biodiversity net gain requirement for development to deliver at least 10% increase in biodiversity, however this requirement is still in its two year transitional period and is not yet in force.
Water Resources Act 1991[2] as amended by the Water Act 2003[3]	The Water Resources Act 1991 states that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Act was revised by the Water Act 2003, which provides the definition of and regulatory controls for the protection of water resources, including the quality standards expected for controlled waters.

Planning policy

13.2.3 A summary of the relevant national and local planning policy is given in **Table 13.2**.

[2] UK Government (1991). Water Resources Act 1991. (online). Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents (Accessed December 2021).
[3] UK Government (2003). Water Act 2003, (online). Available at: https://www.legislation.gov.uk/ukpga/2003/37/contents (Accessed December 2021).

Table 13.2 Planning policy relevant to the agriculture and soil resources assessment

Policy	Policy context
National planning policy	
Overarching National Policy Statement (NPS) for Energy (EN-1)[4]	EN-1 NPS sets out guidance and requirements for major energy infrastructure projects and is relevant to the Project as it requires a pipeline over 16.093km (10 miles) long. EN-1 NPS was published in 2011 and the House of Commons Business, Energy and Industrial Strategy (BEIS) Committee launched a consultation on draft updated NPS documents in 2021, which has since closed. Updated drafts are expected imminently and these place more focus on the environmental 'outcomes' of projects rather than 'impacts'. **Section 5.10:** *"Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed."* (Paragraph 5.10.8). *"The Infrastructure Planning Commission (IPC) should ensure that applicants do not site their scheme on the best and most versatile agricultural land without justification. It should give little weight to the loss of poorer quality agricultural land (in grades 3b, 4 and 5), except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy."* (Paragraph 5.10.15).

[4] Department of Energy & Climate Change (2011), Overarching National Policy Statement for Energy (EN-1): Planning for new energy infrastructure. (Online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf (Accessed May 2022).

Policy	Policy context
	Although not currently in force, it is noted that the updated draft EN-1[5] includes additional guidance and requirements for the protection of soil. **Section 5.11 (draft EN-1)** states that: *"Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land,* *applicants should ensure that they have considered the risk posed by land contamination, and where contamination is present, applicants should consider opportunities for remediation where possible. Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination"* *and,* *"Although in the case of much energy infrastructure there may be little that can be done to mitigate the direct effects of an energy project on the existing use of the proposed site (assuming that some at least of that use can still be retained post project construction) applicants should nevertheless seek to minimise these effects and the effects on existing or planned uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction."*
National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)[6]	EN-4 NPS sets out guidance and requirements for major energy infrastructure projects and is relevant to the Project as it requires a pipeline over 16.093km (10 miles) long. An updated

[5] Department for Business, Energy & Industrial Strategy (2021), Draft Overarching National Policy Statement for Energy (EN-1), September 2021 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf

[6] Department of Energy & Climate Change (2011), National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). (Online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37049/1941-nps-gas-supply-oil-en4.pdf (Accessed May 2022).

Policy	Policy context
	draft of EN-4 NPS is also expected imminently following the consultation by the BEIS Committee. The current NPS states the following in relation to soil and geology. **Section 2.23:** *"New pipelines will be installed in a variety of geological conditions. It will be important for applicants to understand the soil types and the nature of the underlying strata. Underground cavities and unstable ground conditions may present particular risks to pipeline projects. Impacts could include sterilisation of mineral resources or loss of soil quality."* (Paragraph 2.23.1) *"The IPC should take into account the impact on … soils when considering a pipeline project. A proposal will be acceptable from the point of view of soil … if the applicant has proposed a route and other measures (if applicable) that either eliminates any adverse impacts on soil … or reduces them to an acceptable level."* *Mitigation measures to minimise any adverse effects on soil … should include measures to ensure that residual impacts on the surface are minor, for example some differential vegetation growth. Mitigation measures should include appropriate treatment of soil (and in particular topsoil) during site construction and other infrastructure activity (and appropriate soil storage and reinstatement in line with the principles and practices outlined in the Code of Practice for the Sustainable Management of Soils on Construction Sites[7]. The IPC should consider what appropriate conditions should be attached to any consent.* *Where HDD is proposed, the applicant should provide an alternative plan for installing the pipeline in the event that HDD fails. Such alternative means could include open cut, micro-tunnelling and tunnelling.*(Paragraphs 2.23.7 to 2.23.8)

[7] Defra (2009) The Code of Practice for the Sustainable Management of Soils on Construction Sites. (Online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf (Accessed November 2021).

Policy	Policy context
	Section 2.23 (draft EN-4): In Section 2.23 of the updated draft, it is noted that in relation to mitigation measures including for the appropriate treatment of soil (and in particular topsoil) during site construction and other infrastructure activity, that reference is made to the Agricultural Land Classification[8] which provides guidelines on soil handling and restoration criteria, in addition to the Code of Practice for the Sustainable Management of Soils on Construction Sites referred to in the current NPS EN-4.
National Planning Policy Framework (NPPF) 2021	The NPPF at Paragraph 8 states that: *"Achieving sustainable development means that the planning system has three overarching objectives…:* *c) an environmental objective – to contribute to protecting and enhancing our natural… environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, … mitigating and adapting to climate change… "* Paragraph 120 states that: *"planning policies and decisions should:* *b) recognise that some undeveloped land can perform many functions, such as for wildlife, recreation, flood risk mitigation…carbon storage or food production* Paragraph 174 states that: *"Planning policies and decisions should contribute to and enhance the natural and local environment by:* *a) ...protecting and enhancing… valued landscapes, sites of biodiversity… value and soils… (in a manner commensurate with their identified quality in the development plan)* *b)...recognising the economic and other benefits of the best and most versatile agricultural land.*

[8] Natural England (2021) Guide to assessing development proposals on agricultural land. Updated 5 February 2021. (online). Available at: https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land. (Accessed August 2022).

Policy	Policy context
	d)…minimising impacts on and providing net gains for biodiversity" *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil… pollution or land instability* *f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."* Paragraph 175, footnote 53: *"Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality."* Note: Best and most versatile (BMV) land is defined as land in grades 1, 2 and 3a of the Agricultural Land Classification (ALC) system of England and Wales. Paragraph 180 states that when determining applications the planning authorities should refuse development resulting in the loss of deterioration of irreplaceable habitats unless there are wholly exceptional reasons and a compensation strategy exists. The definition of irreplaceable habitat is given as: "*Habitats which would be technically very difficult (or take a very significant time) to restore, recreate or replace once destroyed, taking into account their age, uniqueness, species diversity or rarity. They include ancient woodland, ancient and veteran trees, blanket bog, limestone pavement, sand dunes, salt marsh and lowland fen*." Whilst deep peaty soils are present within the Preliminary Order Limits, no peatland habitats have been identified to date, although it is noted that areas underlain by peat within the Preliminary Order Limits may have the potential to be restored to functioning peatland ecosystems (most of the areas of identified deep peaty soils within the Preliminary Order Limits have been identified as being converted to agricultural or other uses such as roads). The NPPF only references peat directly in relation to the sustainable use of minerals: Paragraph 210 states that planning policies should "*a) provide for the extraction of mineral*

Policy	Policy context
	resources of local and national importance, but not identify new sites or extensions to existing sites for peat extraction." In relation to planning applications for mineral extraction, Paragraph 211 (d) states that planning authorities should not "*grant planning permission for peat extraction from new or extended sites."*
UK Government, England Peat Action Plan May 2021[9]	The Peat Action Plan notes that "*some areas of peatland are potentially susceptible to development pressure and it is vital that planning policies reflect the importance of managing peatlands and avoid detrimental climate, water and biodiversity impacts from development".* The NPPF already promotes the requirement to deliver at least a 10% improvement in "biodiversity value", and the metric used recognises the ecological value of peat, which in turn means there is a strong incentive to retain peatland habitats and to avoid damage to them. The UK Government has identified an action for it to consider how the protection of peatlands in the NPPF can be strengthened. The Peat Action Plan states an intention to ensure that policy and guidance protects peatland, including those which are damaged but recoverable, from potentially damaging development.
Local planning policy	
Cheshire West and Chester Council, Cheshire West and Chester Adopted Development Plan, 29 January 2015[10]	Policy EC21 'Agricultural land' includes a requirement to minimise the loss of greenfield land and high grade agricultural land. Development management policy (DM) 4 'Sustainable construction' states that: *"A CEMP will be required where it is considered that development will result in significant adverse environmental effects, as identified in an Environmental Statement. This will provide the framework for which commitments made in the Environmental Statement or any*

[9] UK Government (2021) England Peat Action Plan. (online) Available at: https://www.gov.uk/government/publications/england-peat-action-plan. (online). (Accessed June 2022).
[10] Cheshire West and Chester Council (2015) Adopted Development Plan documents. (online). Available at: https://consult.cheshirewestandchester.gov.uk/kse/folder/59487 (Accessed May 2022).

Policy	Policy context
	requirements of planning conditions or Section 106 legal agreements can be realised. The CEMP outlines the contractor's approach to environmental management throughout the construction phases with the primary aim of reducing any adverse impacts from construction on local sensitive receivers, including noise and air quality. The CEMP should also take into account other considerations including registration with the Considerate Constructor Scheme and the Code of Practice for the Sustainable Use of Soils on Construction Sites." DM 44 'Protecting and enhancing the environment' states that *"Soil resources must be protected and used sustainably to retain ecosystem services, in line with accepted best practice."* It also states that: *"Development that makes a positive contribution towards the borough's ecological network will be supported. Within the components of the ecological network, as identified on the policies map, proposals should:* • *increase the size, quality or quantity of priority habitat within core areas, corridors or stepping stones;* • *within corridors and stepping stones, improve the connectivity of habitats for the movement of mobile species;* • *in restoration areas, improve the structural connectivity, resilience and function of the network;* • *in buffer zones within core areas and around protected meres and mosses, minimise adverse impacts from pollution or disturbance;* • *contribute towards the integration and creation of green infrastructure and habitats in line with Local Plan (Part One) policy ENV 3."* Policy GE3 'Impact on residential amenity' states that development that gives rise to significant adverse impacts on health and quality of life (e.g. soil…) … will not be allowed.

Policy	Policy context
Cheshire East Council, Cheshire East Local Plan Strategy, 27 July 2017	Policy PG6 'Open Countryside' states that *"within the open countryside only development that is essential for the purposes of … public infrastructure … will be permitted."* Policy SD1 'Sustainable Development In Cheshire East' states that in order to achieve sustainable development, wherever possible, development should: *"make efficient use of land, protect the best and most versatile agricultural land and make best use of previously developed land where possible".* Policy SD2 'Sustainable Development Principles' states that all development will be expected to: *"avoid the permanent loss of areas of agricultural land quality of 1, 2 or 3a, unless the strategic need overrides these issues".* Policy SE2 'Efficient Use of Land' states that development should safeguard natural resources including high quality agricultural land (grades 1, 2, and 3a), geology, minerals, air, soil and water.
Warrington Borough Council, Warrington Local Plan Core Strategy, 21 July 2014	Policy CC2 'Protecting the Countryside' states that development proposals in the countryside which accord with Green Belt policies set out in national planning policy will be supported provided that *"… it can be demonstrated that there would be no detrimental impact on agricultural interests."* The Local Plan vision for 2027 states that the Borough is exercising careful stewardship of the natural environment and has acted to safeguard and enhance vital natural resources including water, air, and soil which help to both mitigate and adapt to climate change.
Trafford Council, Trafford Local Plan Core Strategy, January 2012	Policy R4.5 'Agricultural land' states that the Council will protect existing agricultural land as an important resource for Trafford's local economy. In particular, the Council will seek to protect the Borough's: *(a) Richest soils located south of Carrington Moss (Settled Sandlands) for agricultural purposes; and*

Policy	Policy context
	(b) Pastural landscape located within the Timperley Wedge for agriculture and recreational purposes. Policy R4.7 states that the Council will protect the following areas of open land (that are not included within the Green Belt) from development: *(a) Land in Warburton (immediately to the south of Partington); and* *(b) Land south of Shell, Carrington.*
St. Helens Council, St Helens Core Strategy, 31 October 2012	Policy CAS5 for rural St, Helens states that the positive use of the rural areas will be encouraged to: protect, manage and enhance biodiversity and create opportunities for biodiversity; protect and enhance landscape character; and retain land in agricultural, forestry and related uses. Policy CP1 states that proposals for development within the Borough will be expected, where appropriate, to meet the following standards as a minimum: *(2)(v) Avoid loss or damage to high quality soils where possible and minimise loss or damage where this can be shown to be unavoidable; and (2)(vi). Ensure protection of watercourses from … modification and degradation… and, (3)(i) Minimise and mitigate against the effects of … water pollution (including contamination of soil, surface water and groundwater resources).*
Halton Borough Council, Halton Delivery and Allocations, Local Plan, Adopted 2nd March 2022	Policy CS(R)20 states that a hierarchical approach will be given to the protection, nature conservation and enhancement of biodiversity and geodivesity (including soils), prioritising features with international designations, then national designations, then features of local importance. It is stated that opportunities to enhance the value of Halton's natural assets should be taken including restoring or adding to natural habitats and other landscape features, and the creation of habitats where appropriate. Non-designated peat is only referred to in relation to peat extraction (no new peat extraction sites or extensions are to be identified). Policy HE1 states that:

Policy	Policy context
	" *The irreversible significant development of open agricultural land will not be permitted where it would result in the loss of the best and most versatile agricultural land, except where absolutely necessary to deliver development allocated within the Local Plan, strategic infrastructure or development associated with the agricultural use of land. Where it can be demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality."* This policy has a stated target of no loss of best and most versatile agricultural land Grades 1 and 2.

Technical guidance

13.2.4 A summary of the technical guidance for agriculture and soil resources is given in **Table 13.3**.

Table 13.3 Technical guidance relevant to the agriculture and soil resources assessment

Technical guidance document	Context
Natural England, Guide to Assessing Development Proposals on Agricultural Land (2021)[11]	States that Natural England must be consulted for development proposals that are both: likely to cause the loss (or likely cumulative loss) of 20ha or more of best and most versatile (BMV) land; and, not in accordance with an approved development plan.
Natural England (2012) Technical Information Note TIN049[12]	States that the ALC agricultural land grading system, which considers climate, site, and soil characteristics, is used by Natural England to give advice to planning authorities when

[11] Natural England (2021). Guide to assessing development proposals on agricultural land. (Online). Available at: https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land (Accessed May 2022).
[12] Natural England (2012). Technical Information Note TIN049, Agricultural Land Classification: protecting the best and most versatile agricultural land. (Online). Available at: http://publications.naturalengland.org.uk/publication/35012. (Accessed May 2022).

Technical guidance document	Context
	development is proposed on agricultural land or other greenfield sites that could potentially grow crops.
Highways England (2019) LA109 – Sustainability & Environment Appraisal, Geology and Soils[13]	Highways England's Design Manual for Roads and Bridges LA109 (DMRB) sets out the requirements for assessing and reporting the effects of highway projects on geology and soils. Although designed for highways projects, this document provides a published approach to the assessment of the effects of development on agricultural land and soil in EIAs which can be adopted or adapted for other types of project.
Institute of Environmental Management and Assessment (IEMA) Guidance, A New Perspective on Land and Soil in Environmental Impact Assessment[14]	Provides information on soil and soil functions, provides methodological guidance for how the effects of developments on soils can be assessed in EIA, and provides information on soil handling that can inform soil management plans.
Department for Environment, Food and Rural Affairs (Defra) (2009) Safeguarding our Soils strategy[15]	This strategy aims to help developers and others manage soil sustainably and protect soil functions and is supported by the Defra construction code of practice on the sustainable use of soils on construction sites, to inform development design, construction and after-care phases.

[13] Highways England (2019) LA109 – Sustainability & Environment Appraisal, Geology and Soils. (online). Available at: https://www.standardsforhighways.co.uk/prod/attachments/adca4c7d-4037-4907-b633-76eaed30b9c0 (Accessed August 2022).
[14] Stapleton, C., Reed, E., Gemmell, L., Adams, K. (eds) (2021) IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment. IEMA; London.
[15] Defra (2009) Safeguarding our Soils - A Strategy for England. (online). Available at: https://www.gov.uk/government/publications/safeguarding-our-soils-a-strategy-for-england. (Accessed May 2022).

Technical guidance document	Context
Defra (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.[16]	Outlines current guidance and legislation concerning the use of soil in construction projects, before offering stage by stage guidance on the use, management, and movement of soil on site, and the completion of appropriate soil resource surveys to inform the site working strategy (e.g., Site Waste Management Plan or Material Management Plan) and for the construction phase preparation of a Soil Resource Plan.
Natural Capital Committee (2019) Advice on Soil Management.[17]	The Natural Capital Committee advises that once the decision has been taken to develop an area of land, it is important to retain as many healthy soil functions as practicable by careful management of the soils during construction.
Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2019). Planning Practice Guidance: Natural Environment [18]	The Government's Planning Practice Guidance advises that soil is an essential natural capital resource that provides important ecosystem services, for example as a growing medium for food, timber and other crops; as a store for carbon and water; as a reservoir of biodiversity; and as a buffer against pollution (paragraph 8-002-20190721).
BS6031: 2009 Code of practice for earthworks	Provides recommendations and guidance for unreinforced earthworks forming part of general civil engineering construction, except for dams. This standard also gives recommendations and guidance for temporary excavations such as trenches and pits.

[16] Department for Environment, Food and Rural Affairs (Defra), (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf (Accessed: May 2022).
[17] Natural Capital Committee (2019) Advice on Soil Management. (online). Available at: https://www.gov.uk/government/publications/natural-capital-committee-advice-on-soil-management. (Accessed May 2022).
[18] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2019). Planning Practice Guidance: Natural Environment. (Online) Available at: https://www.gov.uk/guidance/natural-environment (Accessed May 2022).

Technical guidance document	Context
BS3882: 2015 Specification for Topsoil	Specifies requirements for the classification and composition of natural and manufactured topsoils that are moved or traded for creating soil profiles intended to support plant growth. The standard is not applicable to subsoil, or to topsoil that is to remain in situ, however, it is not intended to preclude the use of topsoil that is already on site and suitable for its intended purpose. States that if natural topsoil is to be used without stockpiling, the topsoil shall be sampled before stripping, to the full depth that is intended to be stripped. Before sampling, a soil resource survey shall be carried out in accordance with the Defra Code of Practice 2009. Provides recommendations for topsoil stripping, handling, storage and preparation.
CIRIA Report C692: Environmental Good Practice on Site (2010)	Provides practical advice about managing construction on site to minimise environmental impacts.
CL:AIRE, Definition of Waste Code of Practice (DoWCoP) (2011)	The Code of Practice (CoP) sets out good practice for developers to use when: assessing on a site-specific basis whether excavated materials are classified as waste or not; and, determining on a site-specific basis when treated excavated waste can cease to be waste for a particular use.
Scottish Renewables, Scottish Environment Protection Agency (SEPA) (2012) Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste[19]	There is no UK-wide guidance for developments on peatland, however, guidance exists in Scotland that contains principles which can be applied to all forms of development on peat, although the examples used are taken from wind farms. The guidance sets out an approach to data acquisition in relation to the extent of peat on sites where developments are proposed so that adequate data is obtained to allow robust assessments for each relevant EIA discipline as well as consideration of the waste management aspects.

[19] Scottish Renewables, SEPA (2012) Assessment of peat volumes, reuse of excavated peat and minimisation of waste: guidance (online). Available at: https://www.gov.scot/publications/assessment-of-peat-volumes-reuse-of-excavated-peat-and-minimisation-of-waste-guidance/. (Accessed August 2022).

Technical guidance document	Context
	The overall aim is to minimise the impacts associated with excavation of peat by using the following hierarchy of design principles: prevent excavation; reduce volumes of peat excavated; and reuse excavated peat in a manner to which it is suited. Refers to the Scottish Government, Scottish Natural Heritage (now NatureScot), SEPA (2017) Guidance on Developments on Peatland in relation to peat survey scoping. Recommends the preparation of a draft Peat Management Plan.
Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland[20]	There is no UK-wide guidance for peat survey, however, guidance exists in Scotland which defines a sampling methodology to quantify and qualify peat and advice on how to publish peat surveys as part of wider site investigations for development management applications, with a particular focus on wind farm developments. The guidance includes consideration of how peat surveys interact with other elements of site investigation, and provision of sufficient peat depth and peat quality information to inform site design and layout, Peat Management Plans, carbon savings and losses evaluation, including informing carbon calculator assessments and post-construction habitat management / site reinstatement and restoration.

[20] Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland. (online) Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2018/12/peatland-survey-guidance/documents/peatland-survey-guidance-2017/peatland-survey-guidance-2017/govscot%3Adocument/Guidance%2Bon%2Bdevelopments%2Bon%2Bpeatland%2B-%2Bpeatland%2Bsurvey%2B-%2B2017.pdf (Accessed August 2022).

13.3 Consultation and engagement

Overview

13.3.1 The assessment has been informed by consultation responses and ongoing statutory and technical engagement. An overview of the approach to consultation is provided in **Section 3.4** of **Chapter 3: Approach to preparing the PEIR**.

Scoping Opinion

13.3.2 A Scoping Opinion was adopted by the Secretary of State, administered by the Planning Inspectorate, on 08 March 2022. A summary of the relevant responses received in the Scoping Opinion in relation to agriculture and soil resources and confirmation of how these have been addressed within the assessment to date is presented in **Table 13.4**.

13.3.3 The information provided in the PEIR is preliminary and, as set out in the table below, not all of the Scoping Opinion comments have been addressed at this stage; however, all comments will be addressed within the ES.

Table 13.4 Summary of EIA Scoping Opinion responses for agriculture and soil resources

Consultee	Consideration	How addressed in this PEIR
Planning Inspectorate (PINS)	In the Scoping Report it was proposed that during the operational phase of the Project, temporary loss of topsoil and agricultural land during hydrogen pipeline maintenance activity could be scoped out on the basis that intelligent in-line inspection (ILI) pigging technology will be used so that any intrusive maintenance work can be precisely targeted and is likely to be infrequent and limited in extent. PINS agrees that significant effects are unlikely and that this matter can be scoped out of further assessment.	The design information has been reviewed for this chapter and the proposed inspection and maintenance approach remains the same, therefore temporary loss of topsoil and agricultural land during hydrogen pipeline maintenance activity remains scoped out, as stated in **Section 13.8**.
Natural England	(NE31) States that soils are a valuable, finite natural resource and should be considered for the ecosystem services they provide, including for food production, water storage and flood mitigation, as a carbon store, reservoir of biodiversity and buffer against pollution. It is therefore important that the soil resources are protected and sustainably managed. Impacts from the development on soils and best and most versatile (BMV) agricultural land should be considered in line with paragraphs 174 and 175 of the NPPF. Further guidance is set out in the Natural England Guide to assessing development proposals on agricultural land. (NE32) Natural England note that in paragraph 211 of the NPPF new sites or extensions to sites for peat extraction should not be granted planning permission, and strongly advise maximising the extent of peat	The assessment methodology used in **Section 13.9** considers soil sensitivity in relation to soil functions. In relation to soil's biomass production function, Grade 1 and 2 agricultural land is given very high sensitivity, and grade 3a land is given high sensitivity. Peatlands with ecological conservation designations are avoided by the Project, however, peaty soils are given high sensitivity due to their important carbon/organic matter storage function. Embedded measures to avoid damage to soils and peat are detailed in **Section 13.7**.

Consultee	Consideration	How addressed in this PEIR
	omitted from the development footprint, and the retention of peat in situ (NE35). Natural England's England Peat Action Plan states the aim that all peatlands, not just deep or protected peat, will be responsibly managed, or in good hydrological condition, or under restoration management, and Natural England therefore considers that development on all peat should be omitted as far as possible from the development footprint (NE37). (NE38) Natural England welcomes soil/peat surveys being carried out to inform the assessment of impacts on peat soils. (NE33) It is stated that the following issues should be considered and, where appropriate, included as part of the Environmental Statement (ES): • The degree to which soils would be disturbed or damaged as part of the development. • The extent to which agricultural land would be disturbed or lost as part of this development, including whether any best and most versatile (BMV) agricultural land would be impacted. (NE34). An Agricultural Land Classification (ALC) survey may be required if not available, normally at a one auger per hectare basis, supported by hand dug pits in each soil type to confirm the physical characteristics of the full depth of the soil resource (i.e. 1.2m) to inform soil handling methods and reuse of the soil resource. The ES should set out details of how any adverse effects on BMV agricultural land can be minimised through	

Consultee	Consideration	How addressed in this PEIR
	site design/masterplan, in addition to measures to use and manage soils sustainably. (NE54) The ES should consider the contribution the development could make to relevant local environmental initiatives and priorities to enhance the environmental quality of the development and deliver wider environmental gains. This should include considering proposals set out in relevant local strategies or supplementary planning documents including landscape strategies, green infrastructure strategies, tree and woodland strategies, biodiversity strategies or biodiversity opportunity areas.	
Environment Agency	No specific comments on soils or agricultural land. Includes a note on dewatering i.e., removal / abstraction of water from excavations or lowering of the groundwater table to enable excavation, to the effect that any dewatering activities on-site could have an impact upon local wells, water supplies and/or nearby watercourses and environmental interests. This activity was previously exempt from requiring an abstraction licence. Since 1 January 2018, most cases of new planned dewatering operations above 20m^3/day require a water abstraction licence from the Environment Agency prior to the commencement of dewatering activities at the site.	The baseline information obtained for the PEIR has identified the potential presence of deep peaty soils within the Preliminary Order Limits, and therefore consideration of the effects of the Project on peat, including dewatering, are considered in relation to the peat management measures in the embedded measures in **Section 13.7**. Effects of the Project on the water environment are assessed in **Chapter 7: Water Environment**, and effects on ecology are assessed in **Chapter 5: Biodiversity**.
Cheshire Wildlife Trust (CWT)	CWT note the presence of semi-natural carbon storing habitats within the Scoping red line boundary,	A desk-based review of available information on peat within the Preliminary Order Limits has been

Consultee	Consideration	How addressed in this PEIR
	including peatlands, woodlands and potentially saltmarsh. The potential for release of greenhouse gases during disturbance of these habitats, and potentially over a prolonged period, is noted, in particular in relation to peatlands which are described as particularly susceptible to permanent damage from works including excavation, backfilling, trenching, piling and potentially horizontal directional drilling (HDD). CWT states: *"Peatlands are complex hydrological bodies that cannot simply be re-instated following construction. Therefore, we strongly advise that GHG emissions associated with land use change are scoped in to the EIA.* *Given the 'green' nature of the project we strongly advise that these carbon rich habitats are avoided during construction. The location of deep peat deposits can be identified using the Natural England spatial dataset within the 'NE257 England's peatlands: Carbon storage and greenhouse gases' report."* CWT identifies ten peatland areas within the Scoping red line boundary.	completed, including review of the Natural England peaty soils dataset, information provided by CWT and other publications. Of the ten areas where deep peaty soils were shown within the Scoping red line boundary, seven of these are within the Preliminary Order Limits. These relevant areas are detailed in the baseline information in **Section 13.6**. Ground investigation will be completed prior to the ES and will inform the assessment in the ES. The investigation includes exploratory holes within these areas to provide information on the depth to peat, peat thickness and the condition of the peat. Embedded measures to prevent damage to peat during the construction phase are included in **Section 13.7**. The greenhouse gas assessment for the project is detailed in **Chapter 17: Climate Change and Greenhouse Gases**.
Cheshire East Council	The Council notes that HS2 has the potential to present significant environmental impacts on local receptors and land use both through construction and operation. This includes loss of agricultural land, and there are also anticipated to be significant impacts on biodiversity, and impacts to flood risk and drainage.	A high-level assessment of potential cumulative impacts of the Project is provided in **Section 13.12** and a more detailed assessment will be provided in the ES, following the methodology set out in **Section 3.9** of **Chapter 3: Approach to Preparing the PEIR**.

Consultee	Consideration	How addressed in this PEIR
Cheshire West and Chester Borough Council	In relation to Chapter 12 Ground Conditions of the Scoping Report, the Council states that construction strategies are to be implemented that seek to maximise the reuse of excavated clean material from the pipeline construction corridor where practicable and feasible. Further details regarding the proposals for excavated materials should be provided at the appropriate stage. The Councils Climate Change team state they are broadly supportive of the project and however they note that during construction consideration should be given to the size of the HAGI's and the pipeline route potentially disrupting other land use change for decarbonisation.	The embedded measures to avoid, and where this is not possible, to limit, soil becoming waste are set out in **Section 13.7**. This chapter considers the likely significant effects of the Project on soil including the carbon storage/carbon cycling function of soil. The assessment of the Project's effects with respect to climate change is in **Chapter 17: Climate Change and Greenhouse Gases**.
Historic England	Historic England made the following comments in relation to peaty soils: *This area of Cheshire is low-lying and has the potential for deep deposits of peat and organic-rich alluvium, which could potentially seal former ground surfaces and archaeology which standard geophysical survey methods might not pick up, especially deposits deeper than 1 metre. That is why it is vital to carry out a geomorphological survey of the study area in order to inform the choice of geophysical technique. This may also mean that coring or test pitting may be required in advance of any geophysical work.*	A peat desk study (**Appendix 13A**) has been completed to inform the baseline soil/ground condition and the scope of further surveys to confirm the ground conditions, including the presence, depth, thickness and condition of peat. The findings to date are summarised in the baseline conditions in **Section 13.6**. The assessment of the effects of the Project on the historic environment and details of proposed surveys to support this are provided in **Chapter 6: Historic Environment**.

Consultee	Consideration	How addressed in this PEIR
	We recommend that the second bullet-point of paragraph 6.4.3 should be amended to recognise the potential requirement for borehole survey, especially in areas of alluvium and peat. *Given that the Proposed Development will pass through areas of peat and organic-rich alluvium, particularly in the area around Stanlow and Ince, we suggest that the 'regional literature' referred to in paragraph 6.4.2 should include studies such as Leah et al (2007), The Wetlands of Cheshire.* *Peat and organic-rich alluvium are valuable historic environment resources due to their potential to contain paleoenvironmental information (plant remains, pollen, insects etc.). Such burial environments are susceptible to degradation and geochemical changes including the dewatering of surrounding areas. A preservation and paleoenvironmental assessment should be carried out on any such deposits to assess their potential before any dewatering in the study area.*	

Technical engagement

13.3.4 Other than the Scoping Opinion, no technical engagement with consultees has taken place in relation to agriculture and soil resources. A summary of the technical engagement planned to be undertaken is below.

Planned future engagement

13.3.5 Engagement with Natural England will take place prior to the ES to confirm the scope of the ground investigation and soil/ALC survey and the embedded measures for the Project.

13.3.6 Engagement with the Environment Agency will take place in relation to the possible planned future management of Frodsham Marsh[21].

13.4 Study Area

Spatial scope and study area

13.4.1 The Study Area of the agriculture and soil resources assessment is defined as the land within the Preliminary Order Limits (see **Figures 13.1 to 13.3**). Soil mapping was obtained for the Scoping red line boundary with a buffer beyond this to provide some context for the soil in the surrounding area, this data has been used to inform the agriculture and soil resources assessment for the Preliminary Order Limits and is shown relative to the Preliminary Order Limits on **Figure 13.1**.

13.4.2 For the PEIR assessment no external zones of influence have been applied for soils and agriculture beyond the Preliminary Order Limits. The rationale for the Study Area is that soils and agricultural land are geographically discrete and will typically not be substantially influenced by changes to the surroundings; the potential for significant effects from the Project on agriculture and soil resources will occur due to changes or activities (temporary or permanent) taking place on the resource itself. There may be exceptions to this in some instances, such as large-scale dewatering activity, which could affect groundwater-fed areas of peatland. However, no groundwater dependent terrestrial ecosystems (GWDTEs) have been identified within or adjacent (up to a maximum of 250m) to the Preliminary Order Limits, and dewatering requirements for the Project will be short-term and small-scale. Therefore, no significant effects on soils outside the Preliminary Order Limits due to dewatering are likely.

13.4.3 The Study Area will be reviewed and amended in response to such matters as ongoing iterative design refinement of the Project, the identification of additional impact pathways and in response, where appropriate, to feedback from consultation. The Preliminary Order Limits provides a design envelope at the PEIR stage, sufficient to allow for further design changes. This means that the assessment in the PEIR is intended to provide a worst-case assessment.

[21] Cheshire Live (2010) 'Frodsham Marshes could be flooded to create a wetland nature reserve'. (online). Available at: https://www.cheshire-live.co.uk/news/chester-cheshire-news/frodsham-marshes-could-flooded-create-5200501. (Accessed June 2022).

Temporal scope

13.4.4 The temporal scope of the assessment of agriculture and soil resources will include the construction and operational phases of the Project and the decommissioning phase as described in **Chapter 2: The Project**. **Table 13.10** details agriculture and soil resources receptors scoped in for further assessment and details the agriculture and soil receptors and likely significant effects scoped in for further assessment, and **Table 13.11** details receptors and potential effects scoped out of the assessment.

13.4.5 **As described in Chapter 2: The Project**, the construction phase is anticipated to commence in late 2024 with commissioning in 2027, the Project would be fully operational by late 2027 or early 2028. Pipeline construction typically starts in the spring and is normally planned to be complete by the autumn (i.e., March to September). Two pipelaying seasons, in 2025 and 2026 are expected for the Project. It is expected that construction of each corridor would take 12-18 months. Construction of the HAGIs will take from six to twelve months and may take place at any time of the year, subject to local constraints.

13.4.6 The design life of the pipeline and HAGIs is 40 years, however, the actual life of the pipeline would extend well beyond this period, with parts being replaced or refurbished during maintenance activities. Decommissioning would likely involve leaving the pipeline in situ and making it safe, rail, road and watercourse crossings being filled with grout and the removal of all HAGIs. The land would then be restored to its former use.

13.4.7 The decommissioning of the HAGIs is anticipated to take the same amount of time as construction (6 to 12 months), although this is indicative and may vary.

13.5 Data gathering methodology

Desk study

13.5.1 A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 13.5**.

Table 13.5 Data sources used to inform the agriculture and soil resources assessment

Source	Date of publication	Summary
British Geological Survey (BGS) Onshore GeoIndex	2022	1:50,000 scale geological mapping and borehole records
Gov.uk open data/Multi-Agency Geographic Information for the Countryside (MAGIC) website	2022	OS topographic maps 1:25,000 and 1:50,000 scale

Source	Date of publication	Summary
		Designations (nature conservation), soil mapping, agricultural land classification, habitat mapping
Cranfield Soil and AgriFood Institute (CSAI), supported by Defra	2022	Soilscapes soil types viewer showing broad regional differences in the soil landscapes of England and Wales, soil descriptions
Gov.uk open data	2020	1:250,000 Ministry of Agriculture, Fisheries and Food (MAFF) provisional Agricultural Land Classification (ALC)
Gov.uk open data	2021	Agricultural Land Classification (ALC) Grades – Post 1988 Survey (polygons) for England only The post 1988 ALC maps use the following grades and descriptions: • Grade 1 – excellent quality agricultural land. • Grade 2 – very good quality agricultural land. • Grade 3: – Subgrade 3a – good quality agricultural land. – Subgrade 3b – moderate quality agricultural land. • Grade 4 – poor quality agricultural land. • Grade 5 – very poor quality agricultural land. • Other – this category can be applied to urban (i.e., built up land with little potential to return to agriculture), non-agricultural 'soft' uses such as golf courses or sports fields, also active mineral workings, woodland or open water. The other category can also

Source	Date of publication	Summary
		indicate agricultural land which has not been surveyed.[22]
Natural England Peaty Soils Location[23]	2013	Geospatial information produced by Natural England, with the aim of identifying the extent of three classes of peaty soils for the purposes of the Partnership Project to Protect and Enhance Peat Soils ('The Peat Project'), a joint initiative of Defra, Natural England, the Environment Agency, Forestry Commission, Welsh Assembly Government, Countryside Council for Wales (now Natural Resources Wales), Northern Ireland Environment Agency, Cadw and the Department for Energy and Climate Change (now part of the Department for Business, Energy & Industrial Strategy), and aims to improve coordination between these partners in our efforts to understand, manage and restore peaty soils. This dataset shows areas of deep peaty soils within the Preliminary Order Limits. No shallow peaty soils or soils with peaty pockets are shown.
National Soil Map (NATMAP) 1:250,000	2013	Shows the distribution of 297 soil associations (soil types characteristic of geographical regions based on the most frequently occurring soil series). NATMAP informs the Natural England peaty soils mapping, however, it does not identify areas of deep peat soil series (aka soil types, with specific physical, chemical and bio-indicative characteristics) included within the

[22] Ministry of Agriculture, Fisheries and Food (MAFF) (1988) Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land. (online) Available at: http://publications.naturalengland.org.uk/publication/6257050620264448 (Accessed August 2022).
[23] Natural England (2013) Peaty Soils Location. (online) Available at: https://data.gov.uk/dataset/c9eb1cd9-c254-4128-a18d-d368fbe6acf0/peaty-soils-location. (Accessed August 2022).

Source	Date of publication	Summary
		organo-mineral soil associations. Similarly, some of the deep peat associations also include organo-mineral soil components. Within the Preliminary Order Limits some deep peaty soils lie below a surface layer of mineral soils.
Hall, D. et all (1995) *North West Wetlands Survey 2: The Wetlands of Greater Manchester.*[24]	1995	This publication includes information on Black Moss and Carrington Moss.
Leah, M.D., Wells, C.E., Appleby, C. and Huckerby, E. (1997) *The Wetlands of Cheshire.*[25]	1997	This publication includes information on Sink Moss, Gale Moss, Frodsham and Helsby.
Soil Survey of England and Wales (1987) *Lowland Peat in England and Wales. Soil Survey Special Survey No. 15.*[26]	1987	Includes a map showing areas and names of lowland peat in England and Wales and a report. Includes information on Carrington Moss, Black Moss, Gale Moss and Sink Moss.
University of Salford (2019) Historic Environment Assessment, GMSF Land Allocations, Trafford, GMA45 New Carrington, Appendix 2 (Archaeological Resource), Client: Trafford Council, Technical Report: Anthony Lee & Rachael Reader	2019	Provides information on peat location and thickness in Carrington Moss.
Wood (2022) HyNet Peat Desk Study	2022	A peat desk study was produced to present the findings of a desk-based review of information on the presence of peaty soils within the Preliminary

[24] Hall, D. et all (1995) North West Wetlands Survey 2: The Wetlands of Greater Manchester. Lancaster Imprints, Lancaster.
[25] Leah, M.D., Wells, C.E., Appleby, C. and Huckerby, E. (1997) The Wetlands of Cheshire. Lancaster Imprints, Lancaster.
[26] Soil Survey of England and Wales (1987) Lowland Peat in England and Wales. Soil Survey Special Survey No. 15.

Source	Date of publication	Summary
		Order Limits. In the absence of any UK or England specific guidance, the review was conducted in general accordance with the Scottish Government best practice guide[20], which represents the current best practice for the assessment of peat in the UK (see **Appendix 13A**).

13.5.2 No survey work has currently been completed, however, the following surveys are currently planned to be completed prior with results considered in the ES:

- Preliminary ground investigation including investigation of peat depth and thickness within the identified areas of potential deep peaty soils.
- ALC and soil survey to a targeted scope to be agreed with Natural England.

Data limitations

13.5.3 The baseline information below summarises available desk-based information on the soil and agricultural land within the Preliminary Order Limits. For the ES, ground investigation data and soil and ALC survey findings will be available, and the baseline information will be updated accordingly.

13.6 Overall baseline

Current baseline

Introduction

13.6.1 Soils form over long periods (100s of years) through the interactions of climate, geological conditions, hydrology, and land management, and are effectively finite resources. Soil resources include topsoil and subsoil, and in this section peat is discussed separately due to its unique characteristics, and its importance as a carbon store. Peatland can also preserve unique archaeological and palaeoecological features and information, and this is considered in **Chapter 6**: **Historic Environment.**

13.6.2 Organic matter is usually concentrated in the top part of the soil profile, referred to as the ‘topsoil’, which will often have a loamy texture and a loose, open crumb structure, combined with levels of nutrients that can support plant growth. Subsoils generally have a lower organic matter content and texture closer to their parent material or underlying geological substrate (see geology in paragraph 13.6.5). They are often more compacted and less suitable for plant root penetration and development, with lower nutrient levels.

13.6.3 Desk-based review has identified the likelihood of deep peaty soils being present in seven areas within the Preliminary Order Limits. Available information indicates that the Project avoids areas of healthy peatland habitat with established peat vegetation and avoids all peatland with conservation designations, this will be confirmed through ecological habitat surveys (see **Chapter 5: Biodiversity)**. According to the Environment Agency GWDTE dataset[27], there are no GWDTEs within the Preliminary Order Limits or on adjacent land (up to a maximum of 250m from the Preliminary Order Limits). Most of the identified deep peaty soils are in former wetland areas developed for agriculture, meaning that surface peat will have been drained and damaged, and some may have been removed. In addition to agriculture, other previous development has taken place, including roads and industrial developments (e.g., at Ince Park, Frodsham Substation and Moore). Several of the identified areas with deep peaty soils are in fen peatlands (e.g., from Ince to Frodsham, at Moore, at Appleton south of the M56, and southeast of the M56/M6 intersection, at Dunham Massey and Partington), due to their position in floodplains, fen peatlands can often receive alluvial or marine sediments resulting in peat becoming banded or buried beneath a thick layer of clay and silt deposited by flooding.

13.6.4 The geology of the study area is described from paragraph 13.6.5 onwards. The soil types and likely presence and extent of peat are described from paragraph 13.6.8 onwards.

Geology

13.6.5 British Geological Survey (BGS) mapping indicates that the Study Area is underlain by a mix of glacial till, glaciofluvial sheet deposits, tidal flat deposits, alluvium, the Shirley Hill Sand Formation and peat. In addition, some areas of thin or absent deposits are also shown, for example at Runcorn, and south of Frodsham Marsh. The compositions of the deposits are described as follows:

- Glacial till comprises a mixture of clay, sand, gravel and boulders of varying lithology.
- Tidal flat deposits comprise clay, silt and sand with layers of gravel and peat deposited in the tidal zone of the River Mersey estuary.
- Glaciofluvial deposits comprise sand and gravel.
- Shirley Hill Sand Formation comprises moderately-well to well sorted, fine-grained sand with peat layers in the lower part of the formation.
- River terrace deposits comprise sand and gravel commonly with lenses of silt, clay or peat.

[27] Environment Agency (2020) Groundwater Dependent Terrestrial Ecosystems (England only). (online). Available at: https://data.gov.uk/dataset/72a149a2-1be7-441f-bc37-94a77f261e27/groundwater-dependent-terrestrial-ecosystems-england-only. (Accessed June 2022).

- Alluvium comprises recent deposits of clay, silt, sand and gravel but can contain layers of peat (which generally will not meet the description of deep peaty soils).

13.6.6 BGS mapping indicates the Study Area is underlain by bedrock as follows:

- West Corridor - Chester, Kinnerton, Wilmslow and Helsby Formations of sandstone underlie this corridor. The Tarporley Siltstone Formation (siltstone, mudstone and sandstone) is identified between Frodsham and Rocksavage, and between Rocksavage and the Central Hub. The Corridor is shown to be underlain by the Bollin Mudstone Member.
- North Corridor - the southern portion of this corridor from the Central Hub to Higher Walton is underlain by the Bollin Mudstone Member; Tarporley Siltstone Formation; Wilmslow Sandstone Formation; and the Helsby Sandstone Formation. Between Moore and Cuerdley, bedrock is predominantly the Wilmslow Sandstone Formation. The bedrock geology between Cuerdley and St Helens is dominated by the Chester and Kinnerton Formations of sandstone. In the far north of the corridor the Etruria Formation (mudstone, sandstone and conglomerate) and the Pennine Middle Coal Measures (mudstone, siltstone and sandstone) are also identified.
- East Corridor - most of the Corridor is underlain by the Bollin Mudstone Member, which underlies the route between the Central Hub and the M56 as well as subcropping in the far north of the corridor. In the far north beyond the M56 the Corridor is underlain by sub-crops of the Tarporley Siltstone Formation, Helsby Sandstone Formation, Northwich Halite Member and the Wilmslow Sandstone Formation.
- South Corridor - most of the Corridor is underlain by the Bollin Mudstone Member, including between the Central Hub and the settlement of Moulton. In the far south of the Corridor, the Northwich Halite Member and Sidmouth Mudstone Formation are identified.

Soils

Peat

13.6.7 The Scoping Report and Scoping Opinion responses confirm the presence of peat within the Preliminary Order Limits and Study Area. Areas where peat has been identified are described in more detail based upon desk study research to date. In several areas the identified peat is likely to be below the ground surface.

13.6.8 Peat is formed from decomposed plant remains under waterlogged conditions and there are two distinct types of peat, termed acrotelmic and catotelmic peat. The interface between the two layers is controlled by the position of the water-table. The upper layer of the peat (the acrotelm) is typically fibrous and comprises the living and partially decomposed peat forming plant matter. The thickness of the acrotelm is typically controlled by seasonal variations in the water-table that creates cycles of aerobic and anaerobic conditions near the surface. The catotelm is situated below the minimum average depth of the water-table (Evans and

Warburton, 2010[28]). This results in permanent anaerobic decomposition of the plant matter and the formation of less fibrous amorphous peat. Groundwater levels in areas of potential deep peat within the Preliminary Order Limits are not known; however, these will be measured during the preliminary ground investigation to be completed in 2022, and will inform the assessment in the ES.

13.6.9 In England the following criteria are used to distinguish deep peaty-soils from peaty-soils and mineral soils (JNCC, 2011[29]):

- Mineral soils: soils with an organic horizon <0.1m thick.
- Shallow peaty soils: soils with an organic surface horizon greater than 0.1m but less than 0.4m in thickness, and an organic matter content exceeding 20%.
- Deep peaty soils: a peaty soil as defined above, with a depth greater than 0.4m.

13.6.10 The BGS 1:50,000 superficial geology mapping shows peat within the Preliminary Order Limits in three areas, in the East Corridor only. These comprise a portion of Gale Moss/Appleton Thorn, and the entire extent of Sink Moss and Carrington Moss where they fall within the Preliminary Order Limits.

13.6.11 Review of the Cranfield University NATMAP data identifies four soil associations with peaty characteristics within the Preliminary Order Limits, including Downholland 2, Adventurers' 1, Adventurers' 2, and Turbary Moor (see **Figure 13.1**) and soil description from paragraph 13.6.15 onwards. In addition, BGS information including borehole records and Natural England Peaty Soils Location (England) data, supplemented by information provided by Cheshire Wildlife Trust and the literature review, reveals seven areas of deep peaty soils within the Preliminary Order Limits, as detailed below and shown on **Figure 13.2.** Up to three HAGIs (Rocksavage, Runcorn, Partington) and one Block Valve option are located in these areas, as described below:

- Frodsham, Ince and Helsby Marshes (~218 within Preliminary Order Limits): Fen peatland, in the West Corridor between the settlements of Elton, Frodsham and the River Weaver. The Rocksavage RSH1 HAGI and Runcorn HAGI are located within this area. Previous records indicate that peat is likely to be present at the surface and/or below a thick layer of clay and silt across much of the marshes. A number of BGS borehole records are available in this corridor (mainly associated with ground investigation for the construction of the M56 which runs to the south of the West Corridor) and these generally found a thick horizon of peat encountered beneath clay, silt or sand stratum at depths between 0.2m and 3.0m bgl with peat thicknesses ranging between 0.6m and 4.2m. In a limited number of borehole records, a second and third layer of peat were recorded at thicknesses of between approximately 0.4m and 0.9m. In general, the peat layers are typically underlain by further silt and clay layers overlying glacial till at depths between 2.6m and 16.5m bgl. This area is within

[28] Evans, M. G., and Warburton, J. (2010) Peatland Geomorphology and Carbon Cycling (Geography Compass Volume4, Issue10 October 2010, Pages 1513-1531).
[29] Joint Nature Conservation Committee Report No. 445, Towards an assessment of the state of UK Peatlands, April 2011.

the floodplain of the River Mersey (Environment Agency flood risk zones are considered in **Chapter 7: Water Environment**).

- Halton Moss (~1.7ha within the Preliminary Order Limits): Fen peatland located in the North Corridor on the south side of the Manchester Shipping Canal between Manor Park, Keckwick and Moore within an area that has been heavily developed. Previous investigation records indicate no peat is present, though further investigation will be required to prove the presence or absence of peat. This area is within the floodplain of the River Mersey (Environment Agency flood risk zones are considered in **Chapter 7: Water Environment**).
- Gale Moss/Appleton Thorn (~12.3ha within Preliminary Order Limits): Fen peatland, crosses the East Corridor in two locations approximately 2.7km south of M6 junction 20A. There is no available ground investigation information on the presence or thickness of peat. The Soil Survey Special Survey No.15 says of Gale Moss: "*Appleton, Stretton and Gale Mosses (SJ 640824, 350 ha) are developed in shallow depressions in till. They are drained by Gale Brook into the River Weaver. ... Peat 75 cm thick (range 40-150 cm) has developed over stoneless silty clay overlying loamy sand."* Gale Brook runs through this area and there is an associated flood risk zone (Environment Agency flood risk zones are considered in **Chapter 7: Water Environment**).
- Sink Moss (~22.3ha within Preliminary Order Limits): Fen peatland, located in the East Corridor, on the northeast side of the M6 approximately 1.5km south of junction 20A. A Block Valve option is partially located within the north-eastern extent of this area. A single previous investigation indicates that peat is present beneath a shallow mineral topsoil comprising clay. The Soil Survey Special Survey No.15 says of Sink Moss: "*Only limited deposits of peat were found on the 80 ha of Sink Moss (SJ 680830). The soils here are alluvial and have humose topsoils and thin buried peat layers*". This area is within a flood risk zone (Environment Agency flood risk zones are considered in **Chapter 7: Water Environment**). Leah, M.D., Wells, C.E., Appleby, C. and Huckerby, E. (1997) records Sink Moss being in full cultivation by 1847.
- Black Moss (~7.3ha within Preliminary Order Limits): Raised bog, located in the East Corridor, approximately 200m north of the Trans Pennine Trail at Dunham Woodhouses. There is no available ground investigation information on the presence or thickness of peat. The Soil Survey Special Survey No.15 says of Black Moss: "*Black Moss (SJ 745890,150 ha) along Caldwell Brook carries a mixture of Adventurers', Blackland and Sulham soils, all in arable cropping. There is an average thickness of 45 cm of peat over sand. Topsoils and upper subsoils are moderately acid."*
- Carrington Moss (~18.6ha within Preliminary Order Limits): Raised bog, located in the East Corridor, the proposed Partington HAGI is located within this area. Previous investigation records indicate that surface and subsurface peat is likely to be present at thicknesses ranging between 0.30m and 3.35m bgl. The Soil Survey Special Survey No.15 describes Carrington Moss as having peat accumulated in slight depressions in glaciofluvial gravels along the Mersey valley, and its dome-shape may be the result of the form of the underlying mineral surfaces rather than it being a raised bog in the strict sense. Peat cutting is recorded and the survey says of Carrington Moss: "*Carrington*

Moss (300 ha) is cultivated apart from a small nature reserve under birch and hazel woodland. The soils are Adventurers' and Westhay series with a small area of Isleham soils where the peat thins at the edges. The average thickness of peat is 1.3 m". The Cheshire Lines Railway crosses the southwest of the Moss and it is reported in Hall, D. et all (1995) that attempts were made to drain around 81 hectares of land on the western edge of the Moss. Carrington Moss is also recorded in Hall, D. et all (1995 to have been used for 'nightsoil' disposal (sewage from Manchester city) with the surface 'delved' then nightsoil spread at rate of 60 tons per 0.4 ha between 1885 and c.1910. A road was laid in the late 1880s running east to west with crossroads, and a two-foot (0.6m) gauge track was constructed along the roads to enable distribution over the moss (this track was removed by 1940 as nightsoil disposal ceased around 1910 with improvements to sewage facilities in the city). It is recorded that 'nightsoil' could contain other wastes including broken ceramics, glass fragments and ash. Field boundaries were created, and open drains excavated (1.8m wide by 2.7m deep) in fields adjoining the roads. As reclamation of the Moss continued the site was let to farmers from 1887, and the entire moss was leased for cultivation by 1899. The area north of the Moss was industrialised from the 1800s onwards, including a paper mill and a gasworks. Industrial developments have extended southwards over time into the moss, however most of it has remained under arable cultivation. Hall, D. et all (1995) records a survey of the Moss comprising 22 cores spread across the moss, these found peat cover across the Moss generally between 1 and 2m in thickness, with peat having been destroyed at the northern and western edges, and a small amount removed in the east. It is hypothesised in Hall, D. et all that the site originally had <4m thickness of peat and that agricultural activity has removed 1.5 to 2m of peat on average. The peat was described as quite badly humified (strongly to almost completely decomposed) but with sufficient preservation to allow for detailed palaeoecological analysis, the findings of which are summarised in the publication. A historic environment assessment by University of Salford[30] was available online and this includes a plan showing recorded peat thicknesses within Carrington Moss. In or close to the Preliminary Order Limits this shows peat thicknesses ranging from 1.3m to 2.7m. In relation to the potential for contaminants to be present in soils as a result of the historical land uses and potential land contamination receptors, see **Chapter 12: Ground Conditions**.

- Vale Farm Moss/Unnamed Peatland 1 (2.2ha within Preliminary Order Limits): Fen peatland, located in the South Corridor, approximately 475m southwest of the A556/A559 junction. There is no available ground investigation information on the presence or thickness of peat.

13.6.12 Based on the Preliminary Order Limits, except for Vale Farm Moss, all identified bogs and fens cover all or most of the width of the corridors.

13.6.13 Although they may not have peat at surface or peat vegetation present, the identified fen peatlands, Frodsham, Ince and Helsby Marshes, Halton Moss, Gale

[30] University of Salford (2019) Historic Environment Assessment, GMSF Land Allocations, Trafford, GMA45 New Carrington, Appendix 2 (Archaeological Resource), Client: Trafford Council, Technical Report: Anthony Lee & Rachael Reader.

Moss/Appleton Thorn, Sink Moss and Vale Farm Moss/Unnamed Peatland 1, have the potential for deep peat in the subsurface, potentially within the excavation depth for the hydrogen pipeline.

13.6.14 In their response to the Scoping Report, Cheshire Wildlife Trust identified a further three areas of deep peat, referenced as Moss Wood, Holford Moss and Littledale's Gorse. These three areas are now outside the Preliminary Order Limits and the Study Area for soil resources and are not considered further in the assessment.

All soils

13.6.15 A desk-based review of soil types within the Preliminary Order Limits has been completed using NATMAP data in addition to a review of Ordnance Survey (OS) mapping and information on Soilscapes.

13.6.16 Peaty soil associations are described in paragraphs 13.6.17to 13.6.19. Soils derived from glacial geology, which underlie most of the land within the Preliminary Order Limits, are described in paragraph 13.6.20. The corridors encounter a number of surface watercourses, and the associated alluvial soils are described in paragraph 13.6.21. Soils in areas with shallow bedrock are described in paragraph 13.6.22.

13.6.17 According to NATMAP, the soil association in the West Corridor from Elton to Frodhsam is shown as 851b Downholland 2, described as seasonally wet deep clay, mainly deep stoneless clayey or calcareous silty soils, mainly with a humose (>8 to 12 percent organic matter) surface horizon. The land is described as flat land with groundwater controlled by ditches and pumps. This association is identified in JNCC 2011[31] as a deep peaty soil type and its extent corresponds to the Frodsham, Ince and Helsby Marshes fen peatland identified on the Natural England peaty soils dataset. Carbon storage in these soils is defined in Soilscapes as medium/high. North of Frodsham, where the corridor is crossed by the River Weaver and the Weaver Navigation, the soil association changes to 811b Conway, described as seasonally wet deep silty soil, mainly deep stoneless fine silty and clayey soils variably affected by groundwater. The land is described as flat land with a risk of flooding. The Conway soil association is present further east on the West Corridor and at the northern end of the South Corridor where these are crossed by the River Weaver and Weaver Navigation, and Conway units 811b and U811b also occur at the eastern extent of the Northwich spur. Carbon storage in these soils is defined in Soilscapes as medium.

13.6.18 On the East Corridor there are two areas where the soil association is shown as 1024b Adventurers 2, described as fen peat over glaciofluvial drift Tertiary and Cretaceous sand, mainly deep peat soils over variable subsoils, usually sandy sometimes gravelly. Carbon storage in these soils is defined in Soilscapes as medium/high. The land is described as flat, with complex soil patterns locally. Groundwater levels are controlled by ditches and pumps, and there is a risk of wind erosion. These areas occur south of Arley Airstrip and southeast of the Lymm Interchange. This soil association is identified in JNCC 2011 as a deep peaty soil

[31] JNCC (2011). JNCC Report No. 445, Towards an assessment of the state of UK Peatlands. (online). Available at: https://data.jncc.gov.uk/data/f944af76-ec1b-4c7f-9f62-e47f68cb1050/JNCC-Report-445-FINAL-WEB.pdf. (Accessed June 2022).

type, and corresponds to the Gale Moss/ Appleton Thorn and Sink Moss peatlands identified on the Natural England dataset. The River Bollin crosses the East Corridor as it heads north and the soil association in this area is 811b Conway. Northeast of this the corridor partially intersects an area shown with the 1021 Turbary Moor soil association, ~490m northeast of the proposed Warburton HAGI, comprising raised bog peat with deep earthy peat soils. This corresponds approximately (being slightly smaller in its western extent) to the Black Moss raised bog peatland identified on the Natural England peaty soils dataset. The land is described as having groundwater usually controlled by ditches and pumps, also very acid with high groundwater levels where uncultivated, and with a risk of wind erosion. Carbon storage in these soils is defined in Soilscapes as high. The 1021 Turbary Moor soil association is also shown south and east of the Partington spur, and partially within the proposed Partington HAGI. This corresponds approximately to the Carrington Moss raised bog peatland recorded on the Natural England dataset, which extends slightly further south and west. The Conway unit U811b also occurs at the western extent of the Partington spur.

13.6.19 On the North Corridor, the access route for Option NP4 at Moore, southeast of the Manchester Ship Canal, is shown with the 851b Downholland 2 soil association. This corresponds the Halton Moss fen peatland extent identified by Natural England. At the two Warrington spurs, the soil associations shown are Conway units 811b and U811b, associated with the River Mersey. As the North Corridor heads northwest towards St Helens, between the Manchester Ship Canal and the disused St Helens Canal, it crosses the River Mersey and an area shown with the 812b Wisbech soil association, described as seasonally wet deep silty soil, mainly deep stoneless calcareous coarse silty soils. The land is described as flat with low ridges. Groundwater is usually controlled by ditches or pumps and there is a risk of wind erosion. Carbon storage in these soils is defined in Soilscapes as medium/high. Consideration of the Project's resilience to climate change is presented in **Chapter 18: Climate Change Resilience**.

13.6.20 In higher lying areas and across the majority of the Preliminary Order Limits, including most of the North Corridor and East Corridor, the main Soil associations are Salop, derived from glacial till, and Newport 1, derived from glaciofluvial deposits. The Salop 1 soil association is a seasonally wet deep red loam to clay. These soils are slowly permeable, seasonally waterlogged reddish fine loamy soil, over clayey soil, typically supporting west pasture and woodland habitats. Carbon storage in these soils is defined in Soilscapes as low. There is a risk of surface water pollution associated with this soil association due to its drainage to local stream networks, for example by overland flow of silt-laden water from compacted fields. The Newport 1 association indicates deep sandy soils derived from glaciofluvial drift, typically forming deep drained sandy and coarse loamy soils, supporting habitats including acid dry pastures, acid deciduous and coniferous woodland, and potentially lowland heath. These soils drain to groundwater and are noted to be highly erodible (by wind and water), notably where these soils are in arable use or growing vegetable crops on slopes. Carbon storage in these soils is defined in Soilscapes as medium. At the end of the South Corridor the Crewe soil association is present, comprising of seasonally wet deep red clay derived from glaciolacustrine drift and till, with similar characteristics to Salop.

13.6.21 The Preliminary Order Limits crosses several watercourses, and the Conway soil association alluvial soils are associated with these as follows: the River Weaver and Weaver Navigation at Frodsham and Acton Bridge (West and South Corridors); the River Dane at Bostock Green (South Corridor); the River Bollin at Little Heatley (East Corridor); and the River Mersey and Sankey Brook at Warrington (North Corridor and Warrington Spurs). These seasonally wet deep silty soils occur on flat land with naturally high groundwater, and can support habitats including wet flood meadows and wet carr woodlands. They drain to groundwater which feeds rivers, and within the Preliminary Order Limits, most of this soil association occurs within a floodplain (details of Environment Agency flood risk zones are provided in **Chapter 7: Water Environment**).

13.6.22 At Ince, to the south of Frodsham marshes, and at the end of the Runcorn spur, also at Nutgrove near the end of the North Corridor, NATMAP shows the Bridgnorth soil association. This is a sandy soil over red sandstone, derived from Permo-Triassic and Carboniferous reddish sandstone. The soils are freely draining to groundwater, slightly acid, with low fertility, and are at risk of erosion by wind and water. They support habitats including acid dry pastures, acid deciduous woodland and coniferous woodland, and have potential to support lowland heath.

Agricultural land quality

13.6.23 The provisional ALC mapping shows most of the land in the Preliminary Order Limits as Grade 3 and to a lesser extent Grade 2. Some areas of Grade 3, Grade 4, non-agricultural land and urban land are also shown. The provisional ALC grades are based upon variable degrees of field work completed pre 1988 and consider factors such as soil, gradient, rainfall and altitude. Provisional ALC mapping does not split Grade 3 land into Subgrades 3a and 3b. Without site specific data obtained through survey, and to provide a conservative assessment, the ALC grade of land provisionally assessed as Grade 3 will be assumed to be subgrade 3a which is the lowest grade of land meeting the definition of Best and Most Versatile (BMV) agricultural land.

13.6.24 There is limited coverage by post 1988 ALC mapping of the land within the Preliminary Order Limits. The post 1988 survey data is based on detailed surveys of land affected by planning proposals, shown at 1:10,000 scale, carried out between 1988 and 1999. These were commissioned by MAFF and Defra and use the revised classification system that identifies Subgrades 3a (which along with Grades 1 and 2 is described as BMV land) and 3b (which is not BMV).

13.6.25 In the West Corridor, areas of Grade 3a (BMV) and Grade 3b land are shown southeast of Elton, and centrally along the route of the M56 there is an area of Grade 3b land within the Preliminary Order Limits, and also within the Frodsham, Ince and Helsby Marshes peatland boundary. In the South and East Corridors there is no post 1988 ALC mapping available. In the North Corridor there is an area by Preston-on-the-Hill mapped as ‘other’ between Higher Lane and Newton Lane, further north, an access route south of the Manchester Ship Canal runs through land classed as Grade 3a, Grade 2 and Grade 3b; this land is within the extent of Halton Moss. South of the M62, and south of Warrington Road, the North Corridor runs through a field classed as Grade 3b, with some Grade 3a land adjacent to the Preliminary Order Limits to the west.

13.6.26 The ALC classification data is presented as **Figure 13.3**.

13.6.27 For the ES, site-specific ALC data will be obtained through targeted field survey, the scope of which will be confirmed with Natural England.

Future baseline

13.6.28 Without the Project, the land within the study area is generally likely to remain in its current use.

13.6.29 The National Biodiversity Climate Change Vulnerability Model (NBCCVM) was created to provide a spatial assessment of the relative vulnerability of priority habitats based on established climate change adaptation principles, intended to provide a decision support tool to allow the incorporation of locally specific datasets and selection of adaptation principles to reflect local circumstances and priorities. The MAGIC interactive map shows priority habitats at Frodsham, Runcorn, the proposed Central Hub HAGI, the South Corridor (including Vale Farm Moss/Unnamed Peatland), Northwich spur, and Partington (including Carrington Moss and the proposed Partington HAGI) in areas assessed to be at medium vulnerability to climate change, based on established climate change adaptation principles. The proposed Runcorn and St Helens HAGIs are in areas assessed as having low vulnerability to climate change.

13.6.30 As a result of climate change, the UK is likely to see hotter drier summers and warmer wetter winters, coupled with increased frequency of extreme weather occurrences such as heat waves, dry spells, heavy rain and flooding. This has the potential to have a significant effect on soils, by changing soil properties and functions related to organic matter, water and soil erosion e.g., soil erosion by wind and water is likely to increase, resulting in loss of soil and loss of organic matter, changes to rainfall patterns and groundwater levels will affect vegetation, in turn affecting soil organisms, and there may be increased potential for soil contamination to occur as a result of contaminants transported in flood waters. At present, the effects of climate change on soils and the rate of change to soils because of climate change, are not sufficiently well understood to be quantified, however, the likely effects of climate change on soils (soil health and soil function) are overall likely to be negative rather than positive.

13.6.31 To some extent agriculture can be adapted to mitigate the effects of climate change, for example by changes to tillage, extensions to fallow periods, diversifying crops, changing inputs such as fertilizers, and changes to planting density or planting times. Climate change effects such as increased intensity of flooding could contribute to soil compaction, waterlogging and erosion, which could potentially result in the ALC status of some agricultural land being downgraded, however, a reduction in rainfall could also result in higher grades for wetter areas[32]. As is the case for soil generally, there is too much uncertainty over the scale and timing of the effects to predict them accurately, and as agricultural

[32] C. A. Keay, C.A., Jones, R.J.A., Hannam, J.A., Barrie, I.A. (2012) The implications of a changing climate on agricultural land classification in England and Wales. The Journal of Agricultural Science. Cambridge University Press, 152(1), pp. 23–37. doi: 10.1017/S0021859612000822.

land is already managed there is scope for alternative management approaches to both mitigate negative effects and promote positive effects.

13.7 Embedded environmental measures

13.7.1 As part of the Project design process, several embedded environmental measures are proposed to reduce the potential for impacts on agriculture and soil resources. Table 13.6 outlines how these embedded measures will influence the agriculture and soil resources assessment.

13.7.2 At PEIR stage the preliminary ground investigation has not yet been completed and there is, therefore, uncertainty over the ground conditions, including the presence and extent of peat (the depth to peat, its thickness and its lateral extent within the study area), the ALC of land within the Study Area, and the soil characteristics. The preliminary ground investigation findings will be used to inform the scope of further investigations and to define additional measures to mitigate the Project's potential effects on soils and agricultural resources. Additional measures will also be defined through further consultation with key stakeholders.

Table 13.6 Summary of embedded environmental measures

Embedded measures	Compliance mechanism
Construction phase	
The hydrogen pipeline will be completely buried other than where it comes above ground at HAGIs and Block Valve sites. **This means that the original topsoil and some or all the subsoil can be replaced on top of the pipeline and the topsoil returned to its original state.**	DCO works plans, description of development and requirements
Main rivers and canals, and road and rail crossings (and other sensitive environmental constraints, to be confirmed) will be constructed using trenchless techniques. **This measure avoids the disturbance of trenching in sensitive areas close to watercourses and any associated risks to agricultural land quality/soil.**	Code of Construction Practice (CoCP) to be secured via DCO requirement DCO works plans and Order Limits
Main rivers and canals, and road (primarily A Road and Motorways) and rail crossings (and other sensitive environmental constraints, to be confirmed) will be constructed using trenchless techniques. **This measure avoids the disturbance of trenching in sensitive areas close to watercourses and any associated risks to agricultural land quality/soil.**	CoCP to be secured via DCO requirement DCO works plans and order limits

Embedded measures	Compliance mechanism
The Project generally avoids soils on sensitive ecological sites including Sites of Special Scientific Interest (SSSIs), national nature reserves and local wildlife sites. It also avoids sites with designations for the conservation of archaeological features. Where sensitive features are present, including areas of Ancient Woodland (South Corridor), and cannot be avoided, these will be crossed using a suitable trenchless technique. **Refer to the Crossing Schedule which provides details on which crossings are trenchless or open cut.**	
Each corridor or spur of the hydrogen pipelines will have a working width appropriate to the given section diameter, to minimise environmental impacts. Refer to workplans for construction techniques. **At trenchless crossings, this area will be wider to accommodate the associated equipment and will be kept to a minimum.**	CoCP to be secured via DCO requirement
The footprint of the HAGIs and Block Valves will be minimised to that required for the safe operation and maintenance of the equipment.	CoCP to be secured via DCO requirement
Soils will be managed in accordance with Defra 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (CCOP)[33]. A soil management plan (SMP) will be developed for use during construction to protect soil resources and agricultural land quality. The SMP will be used in conjunction with a Peat Management Plan.	CoCP, SMP, Peat Management Plan to be secured via DCO requirement
Desk-based information review (yet to be supplemented by site investigations) indicates that peat cannot be avoided by the Project. Where reasonably practicable, the Project will therefore apply the general principles in published SEPA guidance 'Developments on Peat and Off-site Uses of Waste Peat'[34] to peat management, including use of the peat	CoCP to be secured via DCO requirement

[33] Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf, (Accessed November 2021).
[34] SEPA (2017) SEPA Guidance – WST-G-52: Developments on Peat and Off-Site Uses of Waste Peat. (online). Available at: https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf. (Accessed June 2022).

Embedded measures	Compliance mechanism
management hierarchy. Although this guidance applies only in Scotland there is no equivalent guidance in England and the guidance can be applied to all types of development on peat.	
For potential areas where peat cannot be avoided by the temporary works or permanent development elements of the Project, an outline Peat Management Plan will be produced, including the measures to be employed to protect peat during handling, storage and reinstatement, to promote its reuse within the Preliminary Order Limits where possible, or offsite if a suitable receptor site can be identified, and avoid it becoming waste. The outline Peat Management Plan will be used in conjunction with the SMP.	CoCP to be secured via DCO requirement
Soils displaced from their original location during construction that cannot be reinstated at the same location due to the Project (e.g., soil removed from HAGIs and Block Valve compounds) will be conserved and reused within the Project boundary wherever possible. This will apply to topsoil and subsoil, with retention of topsoil prioritised. This will be incorporated in the Soil Management Plan and with reference to the Materials Management Plan.	CoCP to be secured via DCO requirement
During construction, topsoil and subsoil will be stored within the temporary working corridor. The topsoil and subsoil will be stored in separate stockpiles in line with Defra CCOP. This will be incorporated in the Soil Management Plan and with reference to the Materials Management Plan.	CoCP to be secured via DCO requirement
During topsoil stripping, machinery with low ground pressure will be used to minimise soil compaction where the soil conditions indicate that compaction is possible. Storage time will be kept to the practicable minimum to prevent the soil deteriorating in quality. Topsoil stripped from different fields will be stored separately, as will soil from hedgerow banks or woodland strips.	CoCP to be secured via DCO requirement
In specific areas (or during periods of adverse weather) there may be the requirement to import aggregates to create a stable surface for construction traffic movements. Options for temporary tracks include stripping the topsoil to allow vehicles to run on the subsoil, use of bog mats or overlaying crushed stone on a geotextile membrane to reduce impact. In construction compounds, crushed stone or tarmac on a geotextile membrane may be used to create a stable surface.	CoCP to be secured via DCO requirement

Embedded measures	Compliance mechanism
Consideration will be given to the timing of construction to lower the risk of adverse weather during earthworks causing damage to soils	CoCP to be secured via DCO requirement
The hydrogen pipeline will be constructed in discrete sections, allowing phased excavation, pipeline laying and reinstatement, to allow reinstatement to take place in as short a timeframe as possible from the point of excavation.	CoCP to be secured via DCO requirement
Stockpiles will be present for the shortest practicable timeframe, with stockpiles being reinstated as the construction work progresses. Stockpiles of topsoil which remain present for six months or longer will be managed (e.g. through seeding) to encourage stabilisation, minimise soil erosion and prevent infestation by nuisance weeds.	CoCP to be secured via DCO requirement
The use of tried and tested invasive species control and biosecurity measures to avoid the spread of infested materials will be applied, in accordance with Natural England, Environment Agency, Defra (2022) guidance[35].	CoCP to be secured via DCO requirement
The SMP will interact with other materials management planning e.g., in relation to contaminated or potentially contaminated soil/materials.	CoCP to be secured via DCO requirement
Management of dewatering of excavations: Dewatering of trench excavations will be carefully monitored and groundwater flow disruption and drawdown will be minimised as much as possible by keeping excavation depths and abstraction rates to an operational minimum. Temporary cut-off drains will be installed to minimise surface water and shallow groundwater ingress into the pipeline trench and other excavations, such as HDD drive and reception pits (should HDD be used) and excavations at HAGI/Block Valve construction sites. Appropriate treatment for dewatered groundwater will be installed before discharge to surface or land.	CoCP to be secured via DCO requirement
Diversion and reinstatement of existing drainage networks: To minimise impacts on surrounding agricultural land particular care will be taken to ensure that the existing land drainage regime is not compromised as a result of construction. Existing land drainage systems will be maintained and	CoCP to be secured via DCO requirement

[35] UK Government (2022) Guidance: How to stop invasive non-native plants from spreading. (online). Available at: https://www.gov.uk/guidance/prevent-the-spread-of-harmful-invasive-and-non-native-plants. (Accessed June 2022).

Embedded measures	Compliance mechanism
diverted as necessary during construction and reinstated on completion.	
A Drainage and Water Management Plan (DWMP) for all construction activities will be developed to support the CoCP. The DWMP will incorporate SuDS principles and specify appropriate treatment and attenuation storage to ensure any discharges to watercourses are uncontaminated and limited to greenfield rates. This will set out surface water drainage measures for the pipeline swathe and associated haul road networks, construction compounds, laydown areas and HAGI/ block valve construction sites. It will also specify measures for the treatment and discharge of dewatered groundwater. The DWMP will be developed by the construction contractor post granting of the DCO and prior to commencement of works and will be secured through a DCO requirement.	CoCP to be secured via DCO requirement
Where potential flood risk receptors could be impacted by a loss of floodplain storage and/or impacts on floodplain conveyance, soil stockpiles (associated with both the pipeline construction and the temporary haul road) will be located outside of the fluvial floodplain wherever possible. Soil stockpile impacts in the floodplain, where unavoidable, will be mitigated through appropriate alignment, leaving gaps and cross-drainage. Haul road levels will be kept as close to existing ground levels as possible. Where haul roads must be raised, cross-drainage will be provided as required.	CoCP to be secured via DCO requirement
Pipeline construction is generally focused on the spring and summer months (March to September) with the aim to reduce impacts on agricultural land. The works for crossings and pipelines in the public highway may occur outside the typical pipelaying season and throughout the year.	CoCP to be secured via DCO requirement

13.8 Scope of the assessment

Maximum design scenario

13.8.1 Assessing the use of a parameter-based design envelope approach means that the assessment considers a maximum design scenario whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the DCO Application. The assessment of the maximum adverse scenario for each receptor establishes the maximum potential adverse impact and as a result impacts of greater adverse significance would not arise should any other development scenario (see the options described in **Chapter 2: The Project**) to that assessed within this chapter be taken forward in the final design of the Project.

13.8.2 The maximum assessment assumptions that have been identified to be relevant to soils and agriculture are outlined in **Table 13.7**.

Table 13.7 Maximum design assessment assumptions

Project phase and activity/impact	Maximum assessment assumptions*	Justification
Construction		
Permanent loss of soil/agricultural land due to construction of above ground elements of the Project	Ten HAGIs are proposed, each up to 2ha in area, giving a maximum total area of 20ha for the HAGI development area. Two Block Valves are proposed, each up to 0.5ha in area, giving a maximum total area of 1.0ha for the Block Valves development area. Some access road/track widening may take place and there is a possibility that this could remain in place after construction, subject to discussions with landowners. This land take has not yet been quantified due to uncertainty over where it will be required, but once confirmed any additional areas of permanent development will be included in the assessment in the ES. The total area of development which could be effectively permanent (soils removed for >40 years) is therefore approximately **21ha**.	These assessment assumptions represent the maximum potential area of permanent development. The total extent of ground disturbance is the sum of ten HAGIs, two Block Valves and estimated worst case land take due to access widening.
Permanent loss of deep peaty soil due to construction of above ground elements of the Project	Of the proposed permanent features, the following are potentially located in areas where deep peaty soils are present: • Runcorn HAGI. • Rocksavage HAGI option RSH1 (but not options RSH2 and RSH3). • Partington HAGI (though this area is noted to be	These assessment assumptions represent the likely maximum potential area of permanent development in areas where there is the potential for deep peaty soils to be present. The total extent is

Project phase and activity/impact	Maximum assessment assumptions*	Justification
	brownfield and some or all peaty soils may have been removed). • Block valve (option site is at north-eastern edge of Sink Moss). Some access road/track widening may take place within areas where potential for deep peaty soils has been identified and there is a possibility that this could remain in place after construction, subject to discussions with landowners. This land take has not yet been quantified due to uncertainty over where it will be required, but once confirmed any additional areas of permanent development will be included in the assessment in the ES. The total area of development which could be effectively permanent (with potential for deep peaty soils to be removed for >40 years) is, therefore, approximately **6.5ha**. Based on available BGS logs, deep peat can potentially be avoided at the Runcorn HAGI and Rocksavage RSH1 due to peat being absent or below required excavation depths, however, in order to provide a conservative assessment it is assumed that some peat will be removed.	the sum of three HAGIs, and one Block Valve.
Permanent loss of deep peaty soil due to construction of below ground elements of the Project	The Peat Desk Study (**Appendix 13A**) concludes that the pipeline route is unlikely to avoid peat, and consequently some surplus peat is likely to be generated during pipeline construction where the pipeline runs through peat and the peat cannot be reinstated (due to	This represents the likely maximum potential area of permanent removal of deep peaty soils during pipeline construction.

Project phase and activity/impact	Maximum assessment assumptions*	Justification
	both the space in the ground that will be occupied by the pipe/insulation materials/engineering backfill and/or if peat is not a suitable material for reinstatement based on its geotechnical properties). There is currently uncertainty over the extent, depth and thickness of peat that the pipeline will encounter. However, desk-based information indicates that around 13.8km of pipeline could run through deep peaty soils. The area of permanent peaty soil removal, due to construction of the pipeline, based on an average width of 1m, could therefore be in the region of **1.3ha**.	
Temporary effects on soil or agricultural land during the construction phase	The total length of the pipeline corridors is estimated at 97.6km (estimated from details in **Chapter 2: The Project, Section 2.4 Development Proposals**. There will be variation from this total, dependant on the selected pipeline route options, however, it is not expected that the resulting change would affect the assessment outcomes). During construction, the working corridor width within the corridors and spurs will vary, depending on the pipeline diameter, from 22m to 36m. Based on the information in **Chapter 2: The Project, Section 2.4 Development Proposals,** the total maximum working area for the pipeline corridors and spurs covers approximately 287.8ha. The total length of the spurs is 17.5km, and the spur working area width is 22m, giving an approximate total working area for the spurs of 40.7ha.	These assessment assumptions represent the likely maximum ground disturbance both in terms of potential area affected during construction and the duration. The total extent of ground disturbance is the sum of ten HAGIs, two Block Valves, the corridors, spurs and an estimate of the land required for access widening.

Project phase and activity/impact	Maximum assessment assumptions*	Justification
	Some access road/track widening may take place which would result in temporary disturbance to soils/agricultural land. This has not yet been quantified due to uncertainty over where it will be required but any additional areas of temporary disturbance will be included in the assessment in the ES. The maximum total working area of soil that could be temporarily disturbed during construction of the Project is, therefore, approximately **328.5ha**.	

*Note: The maximum assessment assumptions are based upon the project description in **Chapter 2: The Project**. The calculation for the total temporary working area is set out in **Table 13.8** below:

Table 13.8 Calculations for the temporary working area

Route section	Length (m)	Width of working corridor relative to pipeline diameter (m)	Area (m2)	Area (ha)
West Corridor	19,400	36	698,400	69.84
North Corridor	29,000	22	638,000	63.8
East Corridor	28,700	28	803,600	80.36
South Corridor	20,500	36	738,000	73.8
Runcorn/Rocksavage spur	3,800	28	106,400	10.64
Warrington spurs	2,000	22	44,000	4.4
Clock Face spur	2,100	22	46,200	4.62
St Helens spur	1,150	22	25,300	2.53
Warburton spur	200	22	4,400	0.44
Partington spur	1,200	22	26,400	2.64

Route section	Length (m)	Width of working corridor relative to pipeline diameter (m)	Area (m2)	Area (ha)
Northwich spur	7,000	22	154,000	15.4
			TOTAL:	**328.47**

Potential receptors

13.8.3 The principal agriculture and soil resources receptors that have been identified as being potentially subject to effects are summarised in **Table 13.9**. In relation to agricultural land receptors, the table below sets out all agricultural land classification grades applied in the MAFF 1988 ALC system. The sensitivity of the agricultural land receptors is assigned as described in **Section 13.9** based on soil functions i.e., the highest performing soils in relation to the biomass production function are assigned the highest sensitivity.

Table 13.9 Agriculture and soil resources receptors subject to potential effects

Receptor	Reason for consideration
Land suitable for agricultural activity is a finite resource, and within England's agricultural land resource is 'best and most versatile land' which is the land where the widest range of crops can be grown successfully. The term 'best and most versatile (BMV)' land is assigned to land classed as Grades 1, 2 or Subgrade 3a according to the MAFF 1988 ALC survey method. Definitions of all the ALC grades defined using this method are provided below: **Grade 1 – excellent quality agricultural land: land with no or very minor limitations. A very wide range of agricultural and horticultural crops can be grown and commonly includes: top fruit, for example tree fruit such as apples and pears, soft fruit, such as raspberries and blackberries, salad crops, and winter harvested vegetables. Yields are high**	The baseline information confirms that within the Preliminary Order Limits there is agricultural land, surveyed post 1988, classed as ALC Grades 1, 2, 3a and 3b. Grades 1 and 2 represent the very best agricultural land in England, and Subgrade 3a is also within the BMV category, referred to in national planning policy due to its economic and other benefits, as a part of the natural and local environment to be protected/enhanced through planning decisions. Other lower ALC grades still represent a valuable and finite agricultural resource and on this basis are also considered as receptors. Provisional ALC mapping covers the remainder of the land within the Preliminary Order Limits and shows most of the land as Grade 3; there are also significant areas shown as Grade 2, and some localised areas of Grade 4, in addition to some non-agricultural and urban land at the extents of the Preliminary Order Limits at Northwich, Partington, Runcorn, Warrington and St Helens.

Receptor	Reason for consideration
and less variable than on land of lower quality. **Grade 2 – very good quality agricultural land: 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.** **Subgrade 3a – good quality agricultural land: Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of crops including: cereals, grass, oilseed rape, potatoes, sugar beet, less demanding horticultural crops.** **Subgrade 3b – moderate quality land capable of producing moderate yields of a narrow range of crops, principally: cereals and grass, or lower yields of a wider range of crops, or high yields of grass which can be grazed or harvested over most of the year** **Grade 4 – poor quality agricultural 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**	A targeted ALC/soil survey will be carried out to update the baseline and the assessment in the ES to confirm the agricultural land quality in areas of permanent above ground development/soil sealing (i.e. HAGIs, Block Valves and potentially permanent accesses where these require land take). The ALC/soil survey will also target a selection of areas where temporary soil sealing and/or below ground development is proposed, to provide some general coverage of the Preliminary Order Limits with regard to the agricultural land grades present.

Receptor	Reason for consideration
land. The grade also includes arable land that is very dry because of drought. **Grade 5 – this is very poor quality agricultural land, with very severe limitations that restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.**	
Soil resources, including peat. Soil is formed over long periods of time and as such is effectively a non-renewable resource. Soils perform a range of important functions including a number of ecosystem services as well as other functions such as conserving archaeological remains. Soils on agricultural land act as growing medium for food, timber and other crops, however they are also a store for carbon and water (and actively involved in the carbon and hydrological cycles), a reservoir of biodiversity, and can provide a buffer against pollution e.g., protecting groundwater quality in deeper aquifers and surface water.	The baseline information identifies a range of soils within the Preliminary Order Limits, including peaty soils, the vast majority of which occur on land now cultivated for agricultural use, and some of which occur below a thin layer of mineral soils. Soils within the Preliminary Order Limits also support terrestrial ecology and biodiversity (see **Chapter 5: Biodiversity** for details of ecological receptors) and provide an important hydrological function including on flood plains within the Preliminary Order Limits (see **Chapter 7: Water Environment** for details of water environment receptors). There is also potential for contamination to be present in soils within the Preliminary Order Limits (see **Chapter 12: Ground Conditions** for details of land contamination receptors). Soils within the Preliminary Order Limits are also likely to hold and conserve archaeological remains (see **Chapter 6: Historic Environment**).

Likely significant effects

13.8.4 The effects on agriculture and soil resources receptors which have the potential to be significant and have been taken forward for detailed assessment are summarised in **Table 13.10**.

Table 13.10 Agriculture and soil resources receptors scoped in for further assessment

Receptor	Likely significant effects
Agricultural land – ALC grades 1 – 5 (including subgrades 3a and 3b*) ***Where only provisional ALC mapping is available it is assumed for the purposes of the assessment that grade 3 is subgrade 3a.** **Soil resources, including peat**	**Soil compaction during construction:** Potential for use of machinery for soil handling and storage during construction to result changes to soil structure (e.g., due to compaction of soil) resulting in loss of soil functions.
	Soil erosion during construction: Potential for vegetation stripping, soil storage, and other construction activities to result in soil erosion by wind, rainfall or flooding and loss of organic matter.
	Damage to soil resources due to temporary removal during construction: Handling and management of soil during excavation, storage and reinstatement resulting in damage to soil health (comprising soil structure, chemistry, organic matter content and permeability to water, as appropriate to the soil type). Examples could include mixing topsoil with subsoil, mixing other excavated materials or contaminated materials with soil, allowing excavated soils to come into contact with invasive weeds.
	Damage to peat during excavation, storage or reinstatement during construction: Handling and management of peat during excavation, storage and reinstatement resulting in damage to peat health (damage to structure, mixing of acrotelm and catotelm, loss of carbon stored in the peat).
	Permanent loss of agricultural land and soil resources during construction: Removal of topsoil and subsoil for construction of HAGIs and Block Valves. The project lifespan is >40 years, therefore, the loss of soil in these areas is assessed as permanent loss.
	Permanent loss of peat during construction: Removal of peat for construction of HAGIs and Block Valves. The project lifespan is >40 years, therefore, potential loss of

Receptor	Likely significant effects
	peat in these areas is assessed as the permanent loss. There is also the likelihood that some surplus peat will be generated during pipeline construction where the pipeline runs through peat and cannot be reinstated (due to both the space in the ground that will be occupied by the pipe/insulation materials/engineering backfill and/or if peat is not a suitable material for reinstatement based on its geotechnical properties).
	Heating of subsurface peat due to gas temperature in pipeline from Hydrogen Production Plant at Stanlow Refinery through Frodsham, Ince and Helsby Marshes (West Corridor): Could result in changes to ground gas emissions from peat (including carbon dioxide and methane greenhouse gases), and possible fire risk due to heating of surrounding peat. Other effects on peat/soil health due to increased soil temperature e.g., caused by changes to soil biota.
	Damage to land drainage systems due to construction activities: Effects may include waterlogging of soils causing damage to soil health/structure

Elements scoped out of further assessment

13.8.5 The receptors/effects detailed in **Table 13.11** have been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant.

Table 13.11 Summary of effects scoped out of the agriculture and soil resources assessment

Receptors/potential effects	Justification
Agricultural land and soil resources – ALC grades 1 – 5 (including subgrades 3a and 3b) / Temporary loss of soil resources and productive agricultural land during operation	The hydrogen pipeline can be inspected internally using intelligent in-line inspection (ILI) pigging technology, meaning that any intrusive maintenance work can be precisely targeted and is likely to be infrequent and limited in extent. The scoping out of temporary loss of topsoil and agricultural land during hydrogen pipeline maintenance activity was agreed by PINS in the Scoping Opinion.

13.9 Methodology for PEIR assessment

Introduction

13.9.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 3: Approach to preparing the PEIR**, and specifically in **Sections 3.7** to **3.10**. However, whilst this has informed the approach that has been used in this chapter, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this agriculture and soil resources assessment.

13.9.2 The assessment of the likely significant effects for agriculture and soil resources is based on the extent of agricultural land and soils that may be affected and whether the effects are temporary or permanent. The assessment is informed by:

- Information about the construction, operation and decommissioning activities associated with the Project;
- Relevant national policy, strategy, legislation and guidance documents; and
- Stakeholder engagement feedback.

13.9.3 The assessment takes into consideration the sensitivity of the affected receptor or resource, and the magnitude of change from the baseline conditions resulting from the Project. This results in an evaluation of significance and an indication of likely significant effects.

13.9.4 Definitions of receptor sensitivity that will be used in the assessment are provided in **Table 13.12**. The receptor sensitivity assessment approach is designed to take account of key soil functions and ecosystem services, including as a growing medium for crops, as a store of organic matter including carbon, providing habitat and supporting biodiversity, and soil's role in the hydrological cycle. There are interactions between soil and receptors covered in other chapters, including those provided in **Chapter 5: Biodiversity**, **Chapter 6: Historic Environment**, **Chapter 7: Water Environment**, **Chapter 12: Ground Conditions**, **Chapter 15: People and Communities** and **Chapter 17: Climate Change and Greenhouse Gases**.

13.9.5 The sensitivity applied to soils is based on the most sensitive receptor identified using the criteria in **Table 13.12.**

Table 13.12 Sensitivity of receptor/resource

Sensitivity	Criteria/description
Very high	Grade 1 and 2 ALC agricultural land. Grade 1: Excellent quality agricultural land with no or very minor limitations to agricultural use. Grade 2: Very good quality agricultural land with minor limitations which affect crop yield, cultivation or harvesting. Soils directly supporting internationally designated sites or European Sites (see **Chapter 5 Biodiversity**) (e.g. Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar).

Sensitivity	Criteria/description
	Peatlands[36] – blanket bog, raised bog, fen peat soils (mapped peatland and peatland with any statutory designation including SSSI)
High	Grade 3a ALC agricultural land: Good quality agricultural land capable of producing moderate to high yields of a narrow range of arable crops or moderate yields of a wider range of crops. Soils (other than peat) directly supporting a UK designated site (e.g. SSSI, Local Nature Reserves (LNR)). Peatland (with peat soil >0.4m thick) not previously mapped and with no statutory designation.
Moderate	Grade 3b ALC agricultural land Soils (other than peat) supporting non-statutory designated sites (e.g., Local Wildlife Sites, Ancient Woodland, Open Mosaic Habitat). Organo-mineral soil (soil with <0.4m thickness of organic material – can include humus-iron podzols, peaty podzols, surface and ground water peaty gleys, peaty rankers and podzolic rankers)[37].
Low	Grade 4 and 5 ALC agricultural land Soils supporting non-designated notable or priority habitats, soils on greenfield sites or soils providing notable community/other benefits (e.g., amenity land in urban areas, parks and gardens).
Very low	Other soils, not in agricultural use or providing notable community/other benefits (e.g., badly damaged or contaminated soils, soils on previously developed land, including soils formerly sealed by development).

13.9.6 Planning guidance and the National Planning Policy Framework (NPPF) refer to the need to protect Best and Most Versatile agricultural land (ALC grades 1,2 and 3a). Hence other agricultural land is regarded as of lower sensitivity. Subgrade 3a land is a more common resource than grades 1 and 2 (the best available both locally and nationally) in northwest England and is, therefore, regarded as of lower sensitivity.

13.9.7 In accordance with the NPPF, which states that undeveloped land can perform many functions, including for wildlife, flood risk mitigation, carbon storage or food

[36] International Union for the Conservation of Nature (IUCN) National Committee United Kingdom (2022). UK Peatlands. (online) Available at: https://www.iucn-uk-peatlandprogramme.org/about-peatlands/uk-peatlands. (Accessed August 2022).
[37] As defined by IUCN (2018). UK Peatland Strategy. (online). Available at: https://www.iucn-uk-peatlandprogramme.org/uk-strategy. (Accessed August 2022).

production, **Table 13.12** assigns highest sensitivity to soils performing key agricultural functions, organic matter (including carbon) storage/cycling functions, flood risk mitigation and biodiversity/wildlife supporting functions at a national level.

13.9.8 Disturbance of soil cannot be avoided by the Project, and it is acknowledged that soil is vulnerable to damage during handling and storage, even if the effect is only temporary, and that some soil types are less resilient to handling than others. For the purposes of the assessment, soil sensitivity will be assessed on a soil function basis. However, it is also acknowledged that during construction, the soil type (e.g., topsoil or subsoil, and specific types of each) and its structural qualities can influence its sensitivity and resilience to structural damage during handling, storage and placement. This level of detail needs to be addressed in soil management planning and will be informed by soil survey and ground investigation. The embedded measures for the Project include development of a Soil Management Plan.

13.9.9 Peat has high sensitivity to handling and presents specific issues for storage and reinstatement/reuse. Where peat cannot be avoided, specific management measures are needed to protect peat during construction, and to protect site users (e.g., from ground stability issues) and the surrounding environment (e.g., from acidic water runoff). These measures are typically detailed in a peat management plan. The embedded measures for the Project include development of a Peat Management Plan. An outline Peat Management Plan is included in **Appendix 13A**.

13.9.10 Based on the current Preliminary Order Limits, except for Halton Moss and Vale Farm Moss, all seven areas of deep peaty soils identified within the Preliminary Order Limits cover all or most of the width of the corridors and as such avoidance is not possible. In the North Corridor the access road through Halton Moss will potentially avoid peat as BGS logs indicate that peat is not present, however ground investigation or peat survey is needed to confirm this. In the South Corridor, Vale Farm Moss may be avoided by routing the pipeline to the northern most West Coast Main Line (Vale Royal Island) crossing near Hartford. Carrington Moss cannot be avoided, however, the Preliminary Order Limits boundary runs through the west of the moss where some peat deposits may already have been removed due to previous industrial developments and former agricultural activity.

Magnitude of change

13.9.11 The assessment of the magnitude of change from baseline conditions includes a consideration of the duration and reversibility of the change in the context of relevant legislation, policy standards and guidance. As the soils within the Preliminary Order Limits are mainly located on agricultural land and some are likely to constitute BMV land[38], the approach to the assessment of magnitude of

[38] Based on the baseline information in **Section 13.6** and review of the Natural England (2017) Predictive BMV Land Assessment, 1:250,000 scale map: North West Region, Likelihood of 'Best and Most Versatile' (BMV) Agricultural Land. (online). The predictive BMV map shows areas of moderate (20 – 60% area likely to be BMV) and high likelihood

change has been guided by current planning guidance and Natural England guidance[39] for developments on agricultural land.

13.9.12 Soil functions are often inter-related, for example, a healthy agricultural soil capable of performing its biomass function to a high standard should also be capable of other key functions, such as storing flood water and supporting biodiversity, however, compaction of this soil would lead to a reduction in all these functions. **Table 13.13** provides examples of how the magnitude of change is determined with respect to soils and agriculture features.

13.9.13 Magnitude of change may be either beneficial or adverse. The criteria and examples in **Table 13.13** focus on adverse changes, however, beneficial changes may also occur and will be considered on a case-by-case basis as required.

Table 13.13 Magnitude of change for agricultural land and soils

Magnitude of change	Description example
Very high	Permanent or long-term temporary (>5 years) loss or significant degradation* of over 80ha of agricultural land or soil.
High	Permanent or long-term temporary (>5 years) loss or significant degradation of between 50ha to 80ha of agricultural land or soil.
Medium	Permanent or long-term temporary (>5 years) loss or significant degradation of between 20ha to 50ha of agricultural land or soil.
Low	Permanent or long-term temporary (>5 years) loss or degradation of up to 20ha of agricultural land or soil or temporary damage over 20ha which will rectify without mitigation.
Very Low	Temporary damage to areas up to 20ha which will rectify without mitigation.

*Significant degradation in this context means that a key soil function is significantly reduced, an example could be that agricultural land classification is reduced due to changes in the soil's structure (e.g., due to compaction).

13.9.14 The magnitude of change on BMV land will depend on the amount to be affected by the Project. The Town and Country Planning (Development Management Procedure) (England) Order 2015[40] only requires Natural England to be consulted on development that involves the loss of greater than 20ha of Grades 1, 2 or 3a

(>60% area likely to be BMV). Available at: http://publications.naturalengland.org.uk/publication/6558375850016768?category=5208993007403008. Checked June 2022.

[39] Natural England (2012). Technical Information Note TIN049, Agricultural Land Classification: protecting the best and most versatile agricultural land. (Online). Available at: http://publications.naturalengland.org.uk/publication/35012. (Accessed May 2022).

[40] UK Government (2022). The Town and Country Planning (Development Management Procedure) (England) Order 2015. (online). Available at: https://www.legislation.gov.uk/uksi/2015/595/contents/made. (Accessed June 2022).

agricultural land that is not on an approved development plan. Consequently, losses smaller than this threshold are considered to have a small magnitude effect on the national stock of BMV land. Losses of over 80ha of BMV land are equivalent to the size of a medium to large farm and consequently the magnitude of impact is considered to be very high. At a national policy level, total farm holdings below 20 hectares in size are generally considered collectively as small farms.

Assessment of effects and determining significance

13.9.15 During the assessment of effects for each identified receptor the sensitivity value in **Table 13.12** will be combined with the magnitude of change from **Table 13.13** to produce an overall significance rating based on the evaluation matrix shown in **Table 13.14**. A 'significant' effect is assessed as a Moderate or Major rating at this stage of the EIA process. The latter will be subject to further investigation as part of the ES following refinement of design information. This approach will be based on professional judgement and carried out on a precautionary basis.

13.9.16 The evaluation of significance for soils will be undertaken drawing upon information about the nature and extent of the soil resources present, their environmental setting and the type of construction activity proposed.

13.9.17 The evaluation of significance for agricultural land quality will draw upon information about the area of BMV agricultural land (defined as Grade 1, 2 and 3a of the ALC) which might be lost or damaged together with contextual data about BMV land within the study area.

Table 13.14 Significance evaluation matrix

		Magnitude of change				
		Very high	**High**	**Medium**	**Low**	**Very low**
Sensitivity, importance or value	**Very high**	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Potentially significant)
	High	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Potentially significant)	Minor (Not significant)
	Medium	Major (Significant)	Major (Significant)	Moderate (Potentially significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Major (Significant)	Moderate (Potentially significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very low	Moderate (Potentially significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

13.10 Preliminary assessment of agriculture and soil resources effects

Construction phase

Introduction

13.10.1 The construction phase is expected to commence in 2025 with commissioning in late 2027 or early 2028. When handled and stored appropriately, soil in temporary storage can be maintained for a period of several years and should be reusable shortly after reinstatement. In practice, soil will be reinstated as early as possible, and within one year where possible, such as at pipeline trenches and trenchless crossing construction compounds, and the working area reduced accordingly to protect the reinstated soils. This will be addressed in the SMP, which is an embedded measure.

13.10.2 Peat requires specific management measures which would be achieved through the use of a Peat Management Plan (PMP) which would interact with other plans including the Soil Management Plan and Materials Management Plan. The development of a PMP is an embedded measure. It is likely that storage periods, stockpile heights and stability, amongst other activities would be described in this PMP.

Soil compaction during construction

Magnitude of change

13.10.3 There is the potential for compaction to occur within all temporary construction compounds, trenchless crossing compounds, pipe and material storage areas, and within the temporary working corridor for the pipeline and spurs, over an area >2,000ha, which is considered of very high magnitude of change. Relevant embedded environmental measures (**Table 13.6**) that will influence the magnitude of change include:

- the avoidance of sensitive sites including areas with European or national statutory conservation designations soils within the Preliminary Order Limits;
- the avoidance of Grade 1 and 2 agricultural land where it is feasible to do so;
- working corridor width will be kept to the minimum required for the given the pipeline diameter at corridors or spurs;
- topsoil and subsoil storage will be in line with the Defra 2009 sustainable use of soils guidance;
- machinery with low ground pressure will be used to reduce compaction;
- bogmatting or geotextiles will be considered by the principal contractor for sensitive areas to protect underlying soil resource;

- the pipeline will be constructed in discrete legs which will minimise the storage time for excavated soil, helping to maintain the physical condition of the soil and minimise the effects of storage on soil chemistry / biology so that reinstated soil can return to normal function as quickly as possible; and,
- implementation of a SMP which will be informed by the site-specific constraints and information gathered during field survey, and will set out further measures to protect soil resources and lower the risk of compaction occurring.

13.10.4 The magnitude of change will be reduced to low to very low, based on the implementation of the above commitments, in particular all working areas being covered by the protective measures to be outlined in the SMP.

Sensitivity or value of receptor

13.10.5 The land within the Preliminary Order Limits is shown on the provisional mapping to be mainly Grade 3, with areas of Grade 2, and then to a lesser extent Grade 4 or non-agricultural land. Where post 1988 ALC grading is available this is limited in extent and shows areas of Grades 3a and 3b in the West Corridor, and Grades 2, 3a and 3b in the North Corridor (see **Figure 13.3**). For this assessment the agricultural land is being considered as overall Subgrade 3a which is considered likely to present the worst-case based on available ALC mapping, and this means that the agricultural land is a high sensitivity receptor. The use of Grade 3a as an average is intended to be conservative overall however the ALC grading within the Preliminary Order Limits may include some Grade 1 or 2 land. The limited post 1988 mapping available shows some Grade 2 land at Warburton HAGI, and the Clockface HAGI. Soil is also considered as a high sensitivity receptor on the basis of its biomass and carbon storage/carbon cycling function, given that the soils within the Preliminary Order Limits include areas of deep peatland soils (with no statutory designation) and it is also noted that soils within the Preliminary Order Limits carry out important hydrological functions given that route goes through a number of flood plains (see **Chapter 7: Water Environment** for the assessment of effects on the Water Environment). Following the planned ALC and soil surveys to be carried out prior to the ES, the sensitivity may need to be revised.

Significance of effect

13.10.6 The embedded environmental measures include avoiding sensitive sites with soils on land designated for nature/biodiversity conservation, working and handling soils in line with the Defra sustainable soils guidance. This includes stockpiling resources separately and using machinery with low ground pressure to reduce compaction and implementation of a SMP. Such measures will further protect soil resources within the Preliminary Order Limits.

13.10.7 As the sensitivity of the receptor is **high** for both agriculture and soil resources within the Preliminary Order Limits, and the magnitude of change, with the implementation of embedded environmental measures, is **low** to **very low**, the effect for both agriculture and soil resources is anticipated to be of minor to moderate adverse significance. With the measures in place the effect would be **Not Significant** in EIA terms.

Soil erosion during construction activities

Magnitude of change

13.10.8 There is the potential for soil erosion (by wind or water) to occur across all soils that are excavated and stockpiled, soils where vegetation is stripped, at all temporary construction compounds, pipe and material storage areas, and within the temporary working corridor for the pipeline and spurs, over an area >2,000ha, which is considered of very high magnitude of change. Relevant embedded environmental measures (**Table 13.6**) that will influence the magnitude of change include:

- working corridor width will be kept to the minimum required for the given the pipeline diameter at corridors or spurs;
- topsoil and subsoil storage will be in line with the Defra 2009 sustainable use of soils guidance;
- measures to avoid/manage soil stockpiles in floodplains;
- machinery with low ground pressure will be used to reduce compaction, which can make soil more vulnerable to erosion;
- bogmatting or geotextiles will be considered by the principal contractor for sensitive areas to protect underlying soil resource;
- the pipeline will be constructed in discrete sections which will minimise the storage time for excavated soil, helping to maintain the physical condition of the soil and minimise the effects of storage on soil chemistry / biology so that reinstated soil can return to normal function as quickly as possible;
- stockpiles will be stored for the shortest amount of time possible and seeded where present for longer than six months; and
- implementation of a SMP which will be informed by the site-specific constraints and information gathered during ALC/soil field survey, and will set out further measures to protect soil resources, including lowering the risk of compaction occurring, which in turn lowers the risk of soil erosion.

13.10.9 The magnitude of change will be reduced to low to very low, based on the implementation of the above commitments, in particular all working areas being covered by the protective measures to be outlined in the SMP.

Sensitivity or value of receptor

13.10.10 For this assessment the agricultural land is being considered as a high sensitivity receptor, and soil is also considered as a high sensitivity receptor. Following the planned ALC/soil survey to be carried out prior to the ES, the sensitivity may need to be revised.

Significance of effect

13.10.11 The embedded environmental measures include minimising the working corridor, measures for working within floodplains including timing of works and other

specific measures to be defined by a Flood Risk Assessment (see **Chapter 7: Water Environment**), seeding soil stockpiles where they will be stored for longer than six months, working in line with the Defra 2009 guidance and handling soils according to a site specific SMP.

13.10.12 As the sensitivity of the receptor is **high** for both agriculture and soil resources within the Preliminary Order Limits, and the magnitude of change, with the implementation of embedded environmental measures, is **low** to **very low**, the effect for both agriculture and soil resources is anticipated to be of minor to moderate adverse significance. With the measures in place the effect would be **Not Significant** in EIA terms.

Damage to soil due to temporary removal during construction, including mixing of topsoil and subsoil, or other cross-contamination

Magnitude of change

13.10.13 Relevant embedded environmental measures (**Table 13.6**) that will influence the magnitude of change in relation to the potential for damage to soil resources during handling in the construction phase include:

- an SMP will be produced based on the site specific data obtained during the soil/ALC survey;
- working corridor width will be kept to the minimum required for the given the pipeline diameter at each corridor or spur;
- topsoil and subsoil storage will be in line with the Defra 2009 sustainable use of soils guidance; and
- the SMP will be used in tandem with a materials management plan (MMP) in accordance with the CL:AIRE Definition of Waste Code of Practice DoWCoP), as detailed in **Chapter 12: Ground Conditions,** and a PMP, informed by the preliminary ground investigation and further investigations as needed.

13.10.14 The magnitude of change will be reduced to low to very low, based on the implementation of the above commitments, in particular all working areas being covered by the protective measures to be outlined in the SMP and its interaction with the Materials Management Plan (MMP) and PMP.

Sensitivity or value of receptor

13.10.15 For this assessment the agricultural land is being considered as a high sensitivity receptor, and soil is also considered as a high sensitivity receptor. Following the targeted ALC/soil field survey to be carried out prior to the ES, the sensitivity may need to be revised.

Significance of effect

13.10.16 The embedded environmental measures include use of a site specific SMP, in conjunction with an MMP and PMP.

13.10.17 As the sensitivity of the receptor is **high** for both agriculture and soil resources within the Preliminary Order Limits, and the magnitude of change, with the implementation of embedded environmental measures, is **low** to **very low**, the effect for both agriculture and soil resources is anticipated to be of minor to moderate adverse significance. With the measures in place the effect would be **Not Significant** in EIA terms.

Damage to peat during excavation, storage or reinstatement

Magnitude of change

13.10.18 Relevant embedded environmental measures (**Table 13.6**) that will influence the magnitude of change in relation to the potential for damage to peat during handling in the construction phase include:

- a PMP (an outline version of which is included in the Peat Desk Study (**Appendix 13A**)) will be produced based on the site-specific data obtained during the preliminary ground investigation and any further peat surveys needed (to be determined in relation to the results of the ground investigation), including the definition between the acrotelm and catotelm, peat characteristics obtained through observation of excavated peat and peat testing, depth to peat and peat thickness in each relevant area;
- peat excavation and reinstatement will be subject to measures outlined in the PMP;
- working corridor width will be kept to the minimum required for the given the pipeline diameter at each corridor or spur;
- the PMP will be used in tandem with the MMP and the SMP (nothing that there are areas within the Preliminary Order Limits where mineral soils overlie peat).

13.10.19 Despite the above measures, there is the potential for excavated peat to be unsuitable for reinstatement. In this instance it may be suitable for reuse elsewhere within the Project or beyond the Preliminary Order Limits, for example to enable local peatland restoration work. If this is not possible, then there is potential for peat to require disposal as waste. This approach follows the peat hierarchy in 'Developments on Peat and Off-site Uses of Waste Peat'[41] which is an embedded measure. The relevant permits for disposal will be gained.

13.10.20 The magnitude of change based upon the desk based information (which indicates up to 268.7ha of deep peaty soils within the Preliminary Order Limits, of which an estimated 46.5ha falls within corridor or spur working areas) is medium (**Table 13.13**). This is a worst-case assessment which assumes the presence of peatland, however, some of the identified peaty soils are likely to have been removed, or damaged, due to historical land uses/land management. In other instances, such as at the eastern extent of the West Corridor, the top of the peat is likely to be below the working depth for corridors/spurs and may not be disturbed.

[41] SEPA (2017) SEPA Guidance – WST-G-52: Developments on Peat and Off-Site Uses of Waste Peat. (online). Available at: https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf. (Accessed June 2022).

Sensitivity or value of receptor

13.10.21 For this assessment the soil, including peatland soils (not within a designated area) within the Preliminary Order Limits is considered as a high sensitivity receptor. The receptor sensitivity is unlikely to change following the planned ground investigation, however, it may be possible to revise (reduce) the estimated area of deep peaty soils occurring within the Project.

Significance of effect

13.10.22 The embedded environmental measures include use of a site specific SMP, in conjunction with an MMP and PMP.

13.10.23 Based on the implementation of the above commitments, the **worst-case** assessment is that there will be a **medium** magnitude of change to a **high** sensitivity receptor which results in a major adverse effect, which is **Significant** in EIA terms. This assessment will be revisited in the ES based on the findings of the ground investigation to determine the presence of deep peaty soils.

Permanent loss of agricultural land and soil resources during construction

Magnitude of change

13.10.24 The Project requires the construction of ten HAGIs and two Block Valves which will involve the permanent loss of up to 21ha of land. This loss is considered to be of medium magnitude of change.

Sensitivity or value of receptor

13.10.25 For this assessment the agricultural land is being considered as a high sensitivity receptor, and soil is also considered as a high sensitivity receptor. Following the planned soil/ALC survey to be carried out prior to the ES, the sensitivity may need to be revised.

Significance of effect

13.10.26 The Project will involve a predicted **medium** magnitude of change to a **high** sensitivity receptor. This will be a permanent effect of **major adverse** significance which is **Significant** in EIA terms. This is a **worst-case** assessment based on the maximum area of permanent development and assumes high sensitivity agricultural land and soil resource within the areas of permanent development. This assessment will be revisited in the assessment within the ES based on the ALC grade of the land, defined by targeted ALC survey and ground investigation to determine the presence of deep peaty soils, to be completed prior to the ES.

Permanent loss of peat during construction

Magnitude of change

13.10.27 Peat is considered as a distinct element of the soil resource due to its unique characteristics, and its importance as a carbon store.

13.10.28 The Project requires the construction of ten HAGIs and two Block Valves. Of these, a maximum up to three HAGIs and one Block Valve option are in areas where peat is potentially present, which could involve the permanent loss of up to 6.5ha of peaty soils (assumed as a worst case to be peatland, however initial review suggests little or no peatland habitat due to conversion of land to agricultural/other use). This loss (based on the loss of a maximum of 6.5ha) is considered to be of low magnitude of change.

13.10.29 Some surplus peat is likely to be generated during pipeline construction where the pipeline runs through peat and cannot be reinstated (due to both the space in the ground that will be occupied by the pipe/insulation materials/engineering backfill and/or if peat is not a suitable material for reinstatement based on its geotechnical properties). There is currently uncertainty over the extent, depth and thickness of peat that the pipeline will encounter. However, this has been estimated at being potentially equivalent to an area of 1.3ha of peaty soils being removed.

Sensitivity or value of receptor

13.10.30 For this assessment the peat within the Preliminary Order Limits, including peatland (with no conservation designation) is considered as a high sensitivity receptor.

Significance of effect

13.10.31 Based on the known areas of permanent development that would potentially result in loss of peat, the Project would involve a predicted **low** magnitude of change to a **high** sensitivity receptor. This would be a permanent effect of **moderate adverse** significance, which due to the importance of peat as a carbon store, its hydrological function, and its potential role in biodiversity conservation, is assessed to be **Significant** in EIA terms. This assessment is based on the maximum area of permanent development where peat could not be replaced due to its geotechnical characteristics, and the presence of deep peaty soils within the areas identified in paragraph 13.6.11 being confirmed by ground investigation.

13.10.32 Using the assessment methodology defined in **Section 13.9** this could increase the area of permanent loss of peaty soils to 7.8ha, which does not change the assessment outcome. A Peat Management Plan is proposed as an embedded measure that the Project will use to minimise the adverse effects on peat during the construction phase.

Damage to land drainage systems due to construction resulting in damage to soil health/structure

Magnitude of change

13.10.33 There is the potential for drains to be damaged within the working corridors and spurs which will impact the surrounding agricultural land and soil, causing waterlogging, erosion and compaction. As drainage layouts are not yet known at this stage of the Project design, the potential area affected cannot currently be quantified. To provide a worst-case assessment, the total extent of the works, >2,000ha, has been used in this assessment.

13.10.34 Embedded environmental measures in **Table 13.6** will protect the existing land drainage regimes during construction and ensure existing systems are reinstated on completion. A construction phase drainage plan will be developed by the construction contractor post granting of the DCO and prior to commencement of works (secured through a DCO Requirement), which would including measures such as temporary cut-off drains to be installed parallel to the trench-line, before the start of construction, to intercept soil and groundwater before it reaches the trench, and use of silt traps, as appropriate, to minimise sediment release. This reduces the magnitude of the change to **very low**.

Sensitivity or value of receptor

13.10.35 For this assessment the agricultural land is being considered as a high sensitivity receptor, and soil is also considered as a high sensitivity receptor. Following the planned ALC/soil survey to be carried out prior the ES, the sensitivity may need to be revised.

Significance of effect

13.10.36 The Project would involve a predicted **very low** magnitude of change to a **high** sensitivity receptor. This would be a permanent residual effect of **minor adverse** significance which is **Not Significant** in EIA terms.

Operational phase

Heating of subsurface soil/peat due to gas temperature in pipeline from Hydrogen Production Plant at Stanlow Refinery through Frodsham, Ince and Helsby Marshes (West Corridor) during operation

13.10.37 The current, available design information indicates potential for hydrogen gas leaving the Hydrogen Production Plant to be at temperatures up to, or in excess of, 40°C. The potential for the heat from the pipeline of the West Corridor to cause drying out of peat, and an associated risk of sub-surface self-ignition of peat has been identified[42]. Further investigation including literature review and ground investigation will be undertaken to establish the level of risk associated with peat self-ignition. Further design work will be undertaken once the additional information has been gathered. Where established, the risk of peat self-ignition will be reduced to an acceptable level through design. Further details will be provided in the ES to update the assessment.

13.10.38 There is potential for soil biota, including soil micro-organisms and larger organisms in soils, including peat, to be adversely affected by increases in soil heat, if heat in the ground exceeds the threshold beyond which specific organisms can survive. This may in turn affect soil health and soil quality, and on agricultural land this could affect the productivity of the soil.

[42] Based on a literature review including: Cygankiewicz, A. (2019) Self-ignition of Peatlands in Central Europe – Possibility Assessment. 19th International Multidisciplinary Scientific GeoConference SGEM 2019

13.10.39 Due to the current uncertainty over the peat extent/condition, pipeline materials, possible use of pipeline insulation, backfill materials, and the maximum temperature of the hydrogen gas leaving the Hydrogen Production Plant, the effect of heat on peat, soil receptors and agricultural land has not been assessed in this PEIR. However an assessment will be provided in the ES based on the further work described above.

Decommissioning phase

13.10.40 The effects during decommissioning are likely to be similar to those during construction, although they will likely be smaller in scale (with some equipment left in situ) and of a shorter duration.

13.11 Preliminary significance conclusions

13.11.1 A summary of the results of the preliminary agriculture and soil resources assessment is provided in **Table 13.15**.

Table 13.15 Preliminary summary of significance of effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Agricultural land and soil resources:				
Soil compaction during construction	High	Low to very low	Moderate (adverse) or Minor (adverse) (Not significant)	The embedded measures including avoidance of sensitive sites, minimising the working corridor, use of equipment with low ground pressure, soil surveys and compliance with the Defra 2009 sustainable use of soils guidance during construction, will minimise soil compaction.
Soil erosion during construction	High	Low to very low	Moderate (adverse) or Minor (adverse) (Not significant)	The embedded measures, including avoiding sensitive sites, minimising the working corridor, measures for storage of soils within floodplains, seeding of soil stockpiles where they will be stored for longer

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				than six months, working in line with the Defra 2009 guidance and handling soils according to a site specific SMP, will minimise the potential for soil erosion.
Damage to soil due to temporary removal during construction, including mixing of topsoil and subsoil, or other cross-contamination	High	Low to very low	Moderate (adverse) or Minor (adverse) (Not significant)	The embedded measures, including use of a site specific SMP, in conjunction with a materials management plan (MMP) and a peat management plan (PMP) will minimise the potential for cross contamination. An outline PMP is included in **Appendix 13A**.
Permanent loss of agricultural land and soil resources during construction	High	Medium	Major (adverse) (Significant)	The permanent above ground development will be the minimum size needed for the Project's operation. The significance may be

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				reduced depending on the design (e.g. by reducing the magnitude through a reduction in the area of land needed), or if high sensitivity receptor areas can be avoided.
Damage to land drainage systems due to construction resulting in damage to soil health/structure	High	Very low	Minor (adverse) (Not significant)	A construction phase drainage plan will be developed, including measures such as temporary cut-off drains to be installed parallel to the trench-line, before the start of construction, to intercept soil and groundwater before it reaches the trench, and use of silt traps, as appropriate, to minimise sediment release.
Soil resources: peat				
Damage to peat during excavation, storage or reinstatement	High	Medium	Major (adverse)	A ground investigation will be completed to

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
			(Significant)	provide site specific information on peat depth and extent and its characteristics, and will inform the PMP, which will be used in conjunction with the MMP and SMP. The peat hierarchy will be followed and peat will be reinstated as soon as it is feasible to do so. If peat cannot be reinstated in its original location, then it may be possible to reuse peat for restoration of other areas within the Preliminary Order Limits or a local site beyond the Preliminary Order Limits undergoing peatland restoration. These measures will reduce the potential for peat to be damaged during construction, however, there is potential for peat

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				to become waste if it is unsuitable for reinstatement.
Permanent loss of peat during construction	High	Low	Moderate adverse (Significant)	The permanent above ground development will be the minimum size needed for the Project's operation. The significance may be reduced through design (e.g., if high sensitivity receptor areas can be avoided following the ground investigation to determine where deep peat is present). Potential permanent loss of peat due to construction of the pipeline is estimated at 1.6ha area of peaty soils being excavated and not reinstated. Once the ground investigation data is available, this will be re-quantified and the assessment and

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				embedded measures updated accordingly.
Heating of subsurface soil/peat due to gas temperature in pipeline from Hydrogen Production Plant at Stanlow Refinery through Frodsham, Ince and Helsby Marshes (West Corridor) during operation	Not assessed at PEIR, however, to be considered in the ES once the baseline information has been updated (based on the ground investigation) and further information is available on elements including the design of the pipeline, insulation solutions, and thermal resistivity of the bedding/backfill material to be placed around the pipeline. The risk of peat self-ignition will be reduced to an acceptable level through design, informed by further assessment (see Section 13.13), however, there may be potential for changes to peat/soil due to heat transfer from the pipeline to surrounding soils during operation and this will be assessed in the ES.			

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 13.9** and is defined as very low, low, medium, high and very high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 13.9** and is defined as very low, low, medium, high and very high.
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (potentially significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 13.9**.

13.12 Further work to be undertaken

13.12.1 The information provided in this PEIR is preliminary, the final assessment of likely significant effects will be reported in the ES. This section describes the further work to be undertaken to support the agriculture and soil resources assessment presented in the ES.

Baseline

13.12.2 A preliminary ground investigation is being carried out within the Preliminary Order Limits. This includes exploratory holes within areas where the potential for deep peaty soils has been identified at approximately 250 to 300m spacing, and throughout the Preliminary Order Limits, including at key locations such as HAGI and Block Valve compounds and trenchless crossings. This investigation, in conjunction with discussions with key stakeholders through further consultation, will inform the requirement for further peat surveys required to inform the ES.

13.12.3 A targeted ALC/soil survey will be carried out to confirm the agricultural land quality in areas of permanent above ground development/soil sealing (i.e. HAGIs, Block Valves and potentially permanent accesses where these require land take). This will be completed prior to the ES to inform the assessment. The ALC/soil survey will also target a selection of areas where temporary soil sealing and/or below ground development is proposed, to provide some general coverage of the Preliminary Order Limits with regard to the agricultural land grades present.

Assessment

13.12.4 No further assessment has been completed for PEIR, however this will be completed for the ES as follows:

- Once preliminary ground investigation data is available, the estimation of peat to be excavated and reused within the Preliminary Order Limits or elsewhere, or which will be surplus to requirements and may become waste, can be undertaken. This will inform the assessment of permanent effects on peat and will be informed by the preliminary ground investigation.
- Assessment of the potential effects of the Project on peat/soil health and agricultural land quality resulting from heating of the soil during operation as hot gas travels through the pipeline. This will be based upon further information on the gas temperature leaving the Hydrogen Production Facility, design information such as the thermal resistivity of the pipeline material, insulation material and engineered backfill materials or site derived materials, and the likely heat dissipation over distance.

13.12.5 A cumulative effects assessment (CEA) will be undertaken for the Project which considers the combined impacts with other developments on the same single receptor or resource (inter-project effects). The detailed method to be followed in identifying and assessing potential cumulative effects is set out in **Section 3.9** of **Chapter 3: Approach to Preparing the PEIR.**

13.12.6 Soils and agricultural land are effectively finite non-renewable resources, and in addition to the Project, other planned developments, both regionally and nationally, will require temporary disturbance to soils, and permanent above ground development. This could result in soil sealing on land currently in 'soft' uses (meaning land uses such as agriculture, nature conservation areas or woodland, where soil resources are present and performing numerous soil functions including ecosystem services).

13.12.7 At a regional level, potential cumulative effects could be identified with HS2, a large-scale linear rail development which requires temporary disturbance to and permanent loss of soils and BMV agricultural land. The proposed Phase 2b western leg of HS2 between Crewe and Manchester intersects the Preliminary Order Limits at the South Corridor.

13.12.8 The HyNet Carbon Dioxide Pipeline CO2 project is due to commence construction in 2024, this is also a linear project including a new underground pipeline, constructed largely using open cut sections and using the excavated material as backfill. The pipeline will be approximately 37km in length and used to transport carbon dioxide captured from existing industrial sources, including the Stanlow Manufacturing Complex and CF Fertiliser Plant, via an onshore pipeline network, compressed at the Point of Ayr Terminal, transported via an offshore pipeline, before being stored in existing depleted oil and gas fields in Liverpool Bay. Above ground installations and block valves are also part of the proposed development. The PEIR for the HyNet Carbon Dioxide Pipeline[43] identifies a moderate adverse (significant) effect on agricultural soil due to the potential loss of >1-20ha of best and most versatile (Grades 1 to 3a ALC land). The PEIR states that this is a worst case assessment, which is based on desk based information on agricultural land classification, and the assessment is to be updated once an ALC survey has been completed. There is potential for cumulative effects with the Project in relation to the loss of agricultural land and other effects on soils including peaty soils due to soil handling, storage and reinstatement.

13.12.9 Local plans are subject to the Environmental Assessment of Plans and Programmes Regulations 2004 (known as the Strategic Environmental Assessment Regulations) and, as stated in Schedule 2, 6., are required to give consideration to their "*likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects*", on issues including soil[44]. This means that cumulative effects on soil resources are given some consideration at a regional level within the planning system. However, there is no legislation or policy framework for soil or (BMV/other) agricultural land which defines an unacceptable loss (due to soil sealing or disposal of soil resources as waste) of these resources either on a spatial (local, regional or national scale) or temporal scale. Notably, there is no systematic data collection on a UK-wide basis

[43] HyNet North West Preliminary Environmental Information Report (Volume II), Chapter 11 – Land and Soils, HyNet Carbon Dioxide Pipeline DCO.
[44] UK Government (2004). S.I. 2004 No. 1633, Environmental Protection, The Environmental Assessment of Plans and Programmes Regulations 2004. (online). Available at: https://www.legislation.gov.uk/uksi/2004/1633/made/data.pdf. (Accessed June 2022).

to record the extent and quality of land sealed by development, or soil resources lost, against which the effects of proposed developments can be compared.

13.12.10 With the Project's embedded environmental measures (**Table 13.6**), there will be limited temporary effects on soils and agricultural land. However, the preliminary assessment identifies the potential for significant effects associated with damage to and loss of peaty soils/peatland, due to pipeline construction and permanent above ground development of HAGIs/Block Valves, and loss of BMV agricultural land. It is possible these effects may act cumulatively with effects from other developments, including HS2. However, the assessment of effects on agricultural land assumes the affected land is BMV; targeted surveys will be undertaken to determine whether this is the case and if the land is of a lower grade. A lower grade land would decrease the sensitivity of the receptor and reduce the effect, potentially resulting in the effect not being significant at the Project level. This would also reduce the potential for significant cumulative effects on agricultural land receptors, through avoidance of effects on the best quality agricultural land.

13.12.11 The effect of HS2 Phase 2b on BMV land during the temporary effects of construction (on approximately 1,995.4ha of land, of which approximately 856.3ha is BMV) was assessed as significant in EIA terms, and the effect due to permanent development (loss of approximately 927ha of agricultural land of which approximately 311ha is BMV), was also assessed as significant in EIA terms[45]. Based on the conclusions of the preliminary assessment presented in this chapter, there would be significant cumulative effects on agricultural land and soil resources due to the effects of the Project in combination with HS2, and also the HyNet CO2 pipeline.

13.12.12 Ground investigation is proposed in areas identified to have potential for deep peaty soils and this will inform the design of the Project and embedded measures, which are to be developed based on the peat hierarchy in 'Developments on Peat and Off-site Uses of Waste Peat'[46], the application of which is an embedded measure. It is possible that the magnitude of impact on peat will be lower than anticipated if the extent of peat and its coincidence with the areas of soil disturbance/permanent development required by the Project is less than expected. However, potential for cumulative effects with other projects on a national scale cannot be ruled out. As is the case for soil sealing/soil loss, there is no systematic data collection on a UK-wide basis for loss of peatland/deep peaty soils. The baseline information in **Section 13.6** illustrates that losses of this resource due to previous developments are frequently not recorded due to survey/modelling information used to produce the mapping being considered out of date.

13.12.13 The CEA for agriculture and soil resources will be refined for the ES based on the agreed short list of other developments to be considered.

[45] High Speed Two (HS2) Limited (2022) High Speed Rail (Crewe – Manchester) Environmental Statement, Volume 3: Route-wide effects.
[46] SEPA (2017) SEPA Guidance – WST-G-52: Developments on Peat and Off-Site Uses of Waste Peat. (online). Available at: https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf. (Accessed June 2022).

Environmental measures

13.12.14 Additional measures and possible mitigation methods will be developed, as required, based upon the findings of the surveys outlined above, and consultation with key stakeholders, and will be detailed in the ES.

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