HyNet North West

ENVIRONMENTAL STATEMENT (VOLUME II)

Chapter 18 Water Resources and Flood Risk

HyNet Carbon Dioxide Pipeline DCO

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulations 5(2)(a)

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18.1. INTRODUCTION

18.1.1. This Chapter reports the assessment of the likely significant effects of the Development Consent Order (DCO) Proposed Development on Water Resources and Flood Risk and describes:

- Relevant, legislation, policy and guidance;
- Consultation undertaken;
- Scope of the assessment;
- Assessment methodology;
- Baseline conditions;
- Sensitive receptors;
- Design development, impact avoidance and embedded mitigation;
- Assessment of Likely Impacts and Effects;
- Mitigation and Enhancement Measures;
- Residual effects;
- Monitoring; and
- Next steps.

18.1.2. This Chapter (and its associated figures and appendices) is intended to be read as part of the wider ES, with particular reference to **Chapter 7 – Climate Resilience,** and **Chapter 11 – Land and Soils (Volume II)** and the following appendices:

- **Appendix 18.1 - Baseline Information (Volume III)**
- **Appendix 18.2 - Assessment of Effects (Volume III)**
- **Appendix 18.3 - Water Framework Directive Assessment (Volume III)**
- **Appendix 18.4 – Flood Risk Assessment (Volume III)**
- **Appendix 18.5 – Flood Consequences Assessment (Volume III).**

18.1.3. This Chapter has been prepared by competent experts with relevant and appropriate experience, as detailed in **Appendix 5.1 - Relevant Expertise and Competency (Volume III).**

18.2. LEGISLATION AND POLICY FRAMEWORK

18.2.1. A summary of the international, national, and local legislation, planning policy and guidance relevant to the water resources and flood risk assessment for the DCO Proposed Development is set out below.

LEGISLATIVE FRAMEWORK

National

Land Drainage Act (1991) **(Ref. 18.1)**

18.2.2. Local Authorities and Internal Drainage Boards have additional duties and powers associated with the management of flood risk under the Land Drainage Act. As Land Drainage Authorities, consent must be given for any permanent or temporary works that could affect the flow within an ordinary watercourse under their jurisdiction in order to ensure that local flood risk is not increased

The Water Resources Act 1991 **(Ref. 18.2)**

18.2.3. The Act governs the quality and quantity of water by outlining the functions of the Environment Agency. The Act sets out offences relating to water and discharge consents. The Environment Agency has the power to bring criminal charges against people or companies responsible for crimes concerning water.

Environment Act 1995 **(Ref. 18.3)**

18.2.4. The aim of the Act relates to a wide range of environmental issues, from the establishment of the Environment Agency to provisions for contaminated land and abandoned mines, National Parks, the control of pollution, conservation of the environment, obligations relating to products and materials, and fisheries.

18.2.5. Part 1 establishes the Environment Agency as a single body with the aim of achieving sustainable development and improving environmental protection. The Agency now applies to England only, with Natural Resources Wales (NRW) taking over its functions in Wales

The Water Act 2003 **(Ref. 18.4)**

18.2.6. This Act is an update to the Water Resources Act 1991 and aims to provide a modern, efficient and robust legislative framework to facilitate both sustainable water resources management and economic growth through the new provisions it contains.

Flood and Water Management Act 2010 **(Ref. 18.7)**

18.2.7. The Flood and Water Management Act 2010 extends the role of the LLFA (in this case FCC and CWCC), set out in the Flood Risk Regulations **(Ref. 18.5)** to take responsibility for leading the co-ordination of local flood risk management in their areas. In accordance with the Flood and Water Management Act, the Environment Agency is responsible for the management of risks associated with main rivers, the sea and reservoirs. LLFAs are responsible for the management of risks associated with local sources of flooding such as ordinary watercourses, surface water and groundwater

The Water Act 2014 **(Ref. 18.8)**

18.2.8. The purpose of the act is to: reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as drought and floods.

Environment Act 2021 **(Ref. 18.13)**

18.2.9. The Environment Act is the UK's new framework of environmental protection. This update was issued following the departure of the UK from the EU. The Act includes the requirements for developments to consider and achieve biodiversity net gain targets.

Flood Risk Regulations 2009 **(Ref. 18.5)**

18.2.10. A framework for managing flood risk over a 6-year cycle, which requires: Production of a Preliminary Flood Risk Assessment; Identification of potential significant risk, referred to as flood risk areas; Mapping of flood hazard and risk; and, Flood Risk Management Plans, setting out measures and actions to reduce the risk. The Regulations require that each of the four elements identified above be reviewed and updated where necessary, at least every six years.

Groundwater (England and Wales) Regulations 2009 **(Ref. 18.6)**

18.2.11. These Regulations implement in England and Wales Community legislation on pollution of groundwater. They provide rules for the granting by the EA of a permit under these Regulations, consent under section 91(8) of the Water Resources Act 1991 and (with exceptions) an environmental permit under the Environmental Permitting (England and Wales) Regulations. In addition, the Regulations create an offence of discharge of a hazardous substance or non-hazardous pollutant without a permit

Environmental Permitting (England and Wales) Regulations 2016 **(Ref. 18.9)**

18.2.12. This is the key legislation for water pollution in the UK. Under the Environmental Permitting Regulations, it is an offence to cause or knowingly permit a water discharge activity, including the discharge of polluting materials to freshwater, coastal waters, relevant territorial waters or groundwater, unless complying with an exemption or an environmental permit. An environmental permit is obtained from the Environment Agency or NRW.

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 **(Ref. 18.10)** and The Groundwater (Water Framework Directive) (England) Direction 2016 **(Ref. 18.11)** and The Groundwater (Water Framework Directive) (Wales) Direction 2016 **(Ref. 18.12)**

18.2.13. The overall objective of the Water Framework Directive (WFD) is to bring about the effective co-ordination of water environment policy and regulation across Europe. The main aims of the legislation are to ensure that all surface water and groundwater reaches 'good' status (in terms of ecological and chemical quality and water quantity, as appropriate), promote sustainable water use, reduce pollution and contribute to the mitigation of flood and droughts

POLICY

National

Overarching National Policy Statement for Energy (EN-1) (**Ref. 18-14)**

18.2.14. Part 5.7 discusses flood risk planning requirements for energy projects. This guidance refers to Planning Policy Guidance (for England) and TAN15 (for Wales), advising that a Flood Risk Assessment and Flood Consequences Assessment will be required for the DCO Application. Part 5.15 discusses water quality and resources, stating that the ES Chapter should consider water quality, quantity, physical characteristics of the water environment and the WFD objectives of water bodies.

National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) **(Ref. 18.15)**

18.2.15. Section 2.22.2 states that constructing pipelines creates corridors of surface clearance and excavation that can potentially affect various receptors such as watercourses, aquifers, water abstraction and discharge points, areas prone to flooding and ecological receptors. Pipeline impacts could include inadequate or excessive drainage, interference with groundwater flow pathways, mobilisation of contaminants already in the ground, the introduction of new pollutants, flooding, disturbance to water ecology, pollution due to silt from construction and disturbance to species and their habitats. It states that impacts during construction should be avoided as far as possible through alignment selection or mitigated if unavoidable and ground should be reinstated after construction.

The Infrastructure Planning (EIA) Regulations 2017 **(Ref. 18.16)**

18.2.16. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the DCO EIA Regulations) set out the requirements for EIA for nationally significant infrastructure projects.

National Planning Policy Framework (2021) **(Ref. 18.17)** and associated Planning Practice Guidance **(Ref. 18.18)**

18.2.17. The National Planning Policy Framework (NPPF) states that planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk. The NPPF and the NPPF Planning Practice Guidance specify that a sequential, risk-based approach should be taken to the location of development to avoid where possible, flood risk to people and property. It states that the planning system should contribute to and enhance the natural environment, by preventing both new and existing development from contributing to or being put at unacceptable risk from or being adversely affected by unacceptable levels of water. The NPPF promotes the use of risk-based sequential tests, recognising that risk is a function of probability and consequence, in which new development is preferentially steered towards the areas at lowest probability of flooding.

Planning Policy Wales (2021) **(Ref. 18.19)**

18.2.18. Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales.

Local

Flintshire County Council Preliminary Flood Risk Assessment (2011) **(Ref. 18.20)**

18.2.19. The Preliminary Flood Risk Assessment provides a high-level summary of flood risk within Flintshire.

Flintshire Local Flood Risk Management Strategy(2013) **(Ref. 18.21)**

18.2.20. The purpose of the strategy is to address potential flood risk arising from local sources within Flintshire and to ensure that communities are aware of the risks that exist and the responsibilities of risk management authorities.

Cheshire West and Chester Council Local Plan, Part 1 (Strategic Policies) (2015) **(Ref. 18.22)**

18.2.21. The purpose of the plan is to provide the overall vision, strategic objective for the borough. Policy ENV1 of the plan relates to flood risk and water management. This plan sets out that developers much follow the sequential approach to planning, assess flood risk through a Flood Risk Assessment, comply with the WFD and North West River Basin Management Plan and Dee River Basin Management Plan, use SuDS in drainage and demonstrate there is adequate network capacity for wastewater and water supply.

Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies – Preferred Approach (2015) **(Ref. 18.23)**

18.2.22. This includes the Strategic Flood Risk Assessment which provides information on existing flood risk within the borough and advises on the applicability of SuDS.

Flintshire County Council Strategic Flood Consequence Assessment (2018) **(Ref. 18.24)**

18.2.23. The Strategic Flood Consequences Assessment was published in 2018 and informs FCC's Local Development Plan and is carried out in accordance with Planning Policy Wales TAN15. The main purpose of the assessment is to identify the key flood risks to communities in Flintshire.

GUIDANCE

National

Technical Advice Note (TAN) 15: Development and Flood Risk (2004) **(Ref. 18.25)**

18.2.24. A planning advice note to support Planning Policy Wales to provide technical guidance in relation to flooding.

Non-Statutory Technical Standards for Sustainable Drainage Systems (2015) **(Ref. 18.26)**

18.2.25. The Non-Statutory Technical Standards for SuDS, published by DEFRA in March 2015, set out the core technical standards for SuDS proposed within England. These standards should be used in accordance with the NPPF and Planning Policy Guidance for Flood Risk and Coastal Change. The standards include guidance on controlling flood risk within a development boundary and elsewhere, peak flow and runoff volume control, and the structural integrity of SUDS.

Planning Inspectorate Advice Note 18: Water Framework Directive (2017) **(Ref. 18.27)**

18.2.26. This advice note provides an introduction to the legal context of DCO applications and WFD. It clarifies the process which should be followed for a DCO application in relation to WFD and gives advice on how this should be presented using optional screening and assessment matrices.

Environment Agency Approach to Groundwater Protection (2018) **(Ref. 18.28)**

18.2.27. This document contains non-statutory position statements which provide information about the Environment Agency's approach to managing and protecting groundwater and, adopts a risk-based approach where legislation allows.

TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment (2019) **(Ref. 18.29)**

18.2.28. Guidance provided to appraise environmental impacts of transport schemes to inform business cases. Although Hynet is not a transport scheme, there is no formal guidance for non-transport projects and therefore this is used as guidance

Design Manual for Roads and Bridges (LA113) (2019) **(Ref. 18.30)**

18.2.29. The DMRB LA 113 sets out the requirements for the assessment and management of the impacts that road projects can have on the water environment, including those related to flood risk. Although the DCO Proposed Development is not a transport project, this document is the most prescriptive guidance available for assessing impacts to the water environment from infrastructure projects, therefore elements of the methodology have been based on this guidance.

NRW's Operational Guidance Note 072: Complying with the Water Framework Directive Regulations (2021) **(Ref. 18.31)**

18.2.30. Planning guidance provided by the Planning Inspectorate and NRW to advise projects on how to ensure they are WFD compliant

18.2.31. Part 5.7 discusses flood risk planning requirements for energy projects. This guidance refers to Planning Policy Guidance (for England) and TAN15 (for Wales), advising that a Flood Risk Assessment and Flood Consequences Assessment will be required for the DCO Application. Part 5.15 discusses water quality and resources, stating that the ES Chapter will consider water quality, quantity, physical characteristics of the water environment and the WFD objectives of water bodies.

National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) **(Ref. 18.15**)

18.2.32. Part 5.7 discusses flood risk planning requirements for energy projects. This guidance refers to Planning Policy Guidance (for England) and TAN15 (for Wales), advising that a Flood Risk Assessment and Flood Consequences Assessment will be required for the DCO Application. The Infrastructure Planning Commission will need to be satisfied that an FRA/FCA has been produced, the sequential test has been followed and that the development prioritises SuDS and is flood resilient.

18.2.33. Part 5.15 discusses water quality and resources and sets out what will be considered in the ES chapter, including water quality, water resources, physical characteristics (quantity and dynamics of flow) and WFD objectives.

18.3. SCOPING OPINION AND CONSULTATION

18.3.1. An **EIA Scoping Opinion (Appendix 1.2 EIA Scoping Opinion, Volume III**) was received by the Applicant from the Planning Inspectorate (The Inspectorate) on 14 July 2021, including formal responses from Statutory Consultees. A full list of the responses from The Inspectorate and how these requirements have been addressed by the Applicant are set out in **Appendix 1.3 – EIA Scoping Opinion and Applicant Response (Volume III).**

CONSULTATION UNDERTAKEN TO DATE

18.3.2. **Table 18.1** provides a summary of the consultation undertaken to inform the Water Resources and Flood Risk assessment to date.

Table 18.1 - Summary of Consultation

Undertaken

Body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
Cheshire West and Chester Council Lead Local Flood Authority (CWCC LLFA)	Engagement	The LLFA (Cheshire West and Chester Council Lead Local Flood Authority) have been contacted via email correspondence on 1 March, 14 March, and 14 April 2022 to request information / feedback. These were followed up by phone call on the 4 May 2022. Consequently, the LLFA confirmed by email correspondence it had received the request. No further response has been received after this communication. It is noted that the LLFA did provide an opinion to the **EIA Scoping Report (Appendix 1.1- EIA Scoping Report (Volume III).**
Flintshire County Council (FCC)	Engagement	Flintshire County Council was contacted on 28 February, 8 April, 22 April, and 10 June 2022 asking for relevant data and inviting FCC to engage with further consultation to influence the design of the DCO Proposed Development.
	Teleconference 5 August 2022	An introduction to the DCO Proposed Development was presented to the LLFA at FCC. This included the location and elements of the DCO Proposed Development relevant to flood risk and drainage. No further advice of data was provided by FCC.
NRW	Teleconference 7 February 2022	Presentation of the WFD screening and scoping exercise for waterbodies within Wales. NRW requested that non-reportable watercourses are considered in the assessment. NRW stated that the DCO Proposed Development cannot prevent future restoration of water bodies. NRW confirmed cycle 3 WFD classification data was now available but the River Basin Management Plans were yet to be published. NRW confirmed it is acceptable to have one Water Framework Directive Assessment (WFDa) to cover both England and Wales.

Body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
	Email correspondence received 24 February 2022	Email correspondence from NRW providing further comments on the WFD screening and scoping conclusion. Generally, the conclusion was acceptable, however further justification was requested for the screening of groundwater bodies and the Pant-Gwyn (Wheeler) water body. NRW provided their internal guidance note (OGN72) to assist with the assessment.
	Email correspondence and memo sent 8 April 2022	A memo was provided which gave a response to the queries raised by NRW in their email correspondence dated 24 February 2022. It was confirmed that further assessment and justification will be provided in the WFDa for screening of groundwater bodies. It was confirmed that there will be one WFDa produced which covered England and Wales.
	Teleconference 14 March 2022	The following key items were noted: • Open cut crossings on all main rivers will require flood risk activity permits (FRAP) • The FCA needs to acknowledge the need for generic mitigation measures for managing flows during the Construction Stage and further details will be required as part of the detailed Construction Environmental Management Plan (CEMP) to be produced by the Construction Contractor, as included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**). • It is acceptable for this FCA to focus on the permanent works only, not on the temporary works (Construction Stage) • For the purposes of this FCA, it is acceptable to refer to the **Outline Surface Water Drainage Strategy Report** (**Document reference: D.6.5.13)** which is being prepared as a separate document. • As the Newbuild Carbon Dioxide Pipeline will be crossing the River Dee a marine license will be required A request was made for site-specific information from the NRW Planning Department and NRW Asset Management Department. Correspondence received to date from NRW can

Body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
		be seen in Annex B of **Appendix 18.5 – Flood Consequences Assessment (Volume III)**.
	Teleconference 25 May 2022	Presentation of the proposed crossing method at Alltami Brook. This included a discussion on the crossing location and the crossing method. NRW was invited to comment on the proposals and whether they could be classed as WFD compliance regarding the buried pipeline and future plans to restore the channel.
	Email correspondence received 29 June 2022	NRW requested further justification for the method and location of the crossing of Alltami Brook. NRW suggested crossing at the A55 culvert and did not accept the justification for discounting the exposed pipe bridge option as satisfactory. The current proposals for the Alltami Brook are considered High Risk regarding WFD and not likely to be compliant. In addition, NRW is not likely to consent open cut through bedrock due to irreparable damage to hydromorphology.
	Teleconference 19 July 2022	The potential crossing methods of Alltami Brook were presented to NRW with explanations of why some methods have been discounted. The advantages and disadvantages of these options were discussed.
	Email correspondence received 8 August 2022	NRW provided what they considered to be the advantages and disadvantages of the open trench, pipe bridge and auger boring methodologies for crossing the Alltami Brook. NRW stated that it will advise on WFD compliance once the DCO Application was submitted but welcomed further engagement through the examination stage.
Environment Agency	Teleconference 2 March 2022	Presentation of the WFD screening and scoping exercise for waterbodies within England. Environment Agency requested all main rivers are assessed in the WFDa, not just the monitored water bodies. Environment Agency confirmed it is acceptable to have one WFDa to cover both England and Wales. Environment Agency provided the mitigation measures for the relevant water bodies in England. This includes the intention to set back the left bank embankment on the River Gowy to allow re-naturalisation of the channel planform.

Body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
		Where possible the Environment Agency requested that temporary crossings span the watercourse. Where culverting is required and assessment of flood risk should be completed. This does not need to involve hydraulic modelling but structures will need to be of sufficient capacity. The Manchester Ship Canal should be screened in for water quality elements only as it receives water pumped from Ince Marshes. The Environment Agency agreed to permanent impacts being covered in the Flood Risk Assessment and that Construction Stage impacts can be covered off in the permit applications which will be applied for after the DCO Application.
	Email correspondence June 2022	Environment Agency provided hydraulic fluvial models dated 2004, the Stanlow & Tranmere_Hydraulic Report (**Ref. 18.30**), the River Gowy hydraulic model and the state of the existing flood defences. On 6 June 2022, the Environment Agency confirmed that no flood storage compensation will be required as the proposed Above Ground Installation (AGI) at Ince is beyond flood defences. Moreover, it has been confirmed that raising the proposed AGI levels is an effective to reduce flood risk in the area. On the 7 June 2022 the Environment Agency confirmed the emergency procedure in case of pump failure at the Ince marshes stating "*The two pumping Stations mentioned below are monitored and alarms are generated should the pumping stations fail, The EA would respond to these failures by investigating the faults within the 4 hours. A repair or Contingency would be implemented if needed later*."

18.4. SCOPE OF THE ASSESSMENT

18.4.1. The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 5 - EIA Methodology (Volume II)** of this ES.

18.4.2. This section provides an update to the scope of the assessment and re-iterates the evidence base for scoping out elements following further iterative assessment.

ELEMENTS SCOPED OUT OF THE ASSESSMENT

18.4.3. The elements shown in **Table 18.2** are not considered to give rise to likely significant effects as a result of the DCO Proposed Development and have therefore not been considered within this assessment. Further detail is provided in **Appendix 1.3 Scoping Opinion Responses (Volume III).**

18.4.4. WFD receptors are scoped in the Water Framework Directive Assessment (WFDa) **(Appendix 18.3 – WFDa, Volume III)** and not covered in this section.

Table 18.2 - Elements scoped out of the assessment

Element Scoped Out	Stage of Work	Justification
Works and flooding impacts arising from the Flint Connection to Point of Ayr (PoA) Terminal Pipeline (excluding Block Valve Stations (BVSs))	Construction, Operation	No physical works consented within the DCO Application. Therefore, no impact pathways relevant to water and flooding. Decommissioning and pre-commissioning works of the existing pipeline include the hydrostatic testing which is assessed as part of the Newbuild Carbon Dioxide Pipeline. The connection to the Newbuild Carbon Dioxide Pipeline is below ground and does not impact flood risk during the Operation Stage. Construction Stage impacts are assessed generally as part of the Newbuild Carbon Dioxide Pipeline.
Surface water		
Ponds within 250m of the Newbuild Infrastructure Boundary	Construction, Operation, Decommissioning	Ponds upslope of the DCO Proposed Development are not hydrologically connected and therefore will not be impacted. Ponds within the Newbuild Infrastructure Boundary are small ephemeral features which have very local land drainage use and therefore the DCO Proposed Development is not anticipated to cause a significant impact to the hydrological value of these features. The value of these ponds is in the habitat they provide and therefore any impacts associated with this attribute is assessed in **Chapter 9 - Biodiversity (Volume II).**
Ordinary Watercourse Upstream or Upslope of the DCO Proposed Development	Construction, Operation, Decommissioning	The DCO Proposed Development will not directly or indirectly affect these water bodies.
Public and Private Drainage Assets	Construction, Operation, Decommissioning.	The DCO Proposed Development will not directly or indirectly affect these water bodies. The only exception is at Stanlow AGI, however the area is already developed and the drainage strategy for the Stanlow AGI is to link into the existing drainage system. If the hydrostatic testing water is discharged to the network, the potential impacts will be controlled through the permit application to the asset owner.

Element Scoped Out	Stage of Work	Justification
Public Water Supply	Construction, Operation, Decommissioning	Hydrostatic testing water may be abstracted from the public water supply. The potential impacts of this will be controlled through a permit application to the asset owner. The Newbuild Carbon Dioxide Pipeline may cross the public water supply however these crossings will be managed in conjunction with the utility owners, and no impact is anticipated.
Groundwater		
Secondary B aquifers, Secondary Undifferentiated aquifers and unproductive strata	Construction, Operation, Decommissioning	Aquifers which have been classified as Secondary B or Secondary (undifferentiated) and have a relatively low sensitivity based on the LA113 guidance (**Ref. 18.30**). Additionally, the footprint of the DCO Proposed Development above those aquifers is minimal. Unproductive strata have a low sensitivity; therefore, it has been concluded that the DCO Proposed Development will not significantly impact these receptors.
Groundwater abstractions and Source Protection Zones greater than 1 km from the Newbuild Infrastructure Boundary	Construction, Operation, Decommissioning	The dewatering calculations have resulted in a maximum radius of influence (less than 150 m) significantly less than 1 km from the Newbuild Infrastructure Boundary and the majority of the DCO Proposed Development is covered by the relatively low permeability glacial till and tidal flat deposits. Furthermore, for significant dewatering activities that exceed the abstraction regulations of the Environment Agency and NRW, permits will be required which will limit the potential impact of the DCO Proposed Development. Therefore, the DCO Proposed Development will have a negligible impact on groundwater resources which are more than 1 km away.
Groundwater Dependant Terrestrial Ecosystems greater than 1 km from the Newbuild Infrastructure Boundary	Construction, Operation, Decommissioning	The dewatering calculations have resulted in a maximum radius of influence (less than 150 m) significantly less than 1 km from the Newbuild Infrastructure Boundary and the majority of the DCO Proposed Development is covered by the relatively low permeability glacial till and tidal flat deposits. Furthermore, for significant dewatering activities that exceed the abstraction regulations of the EA and NRW, permits will be required which will limit the potential impact of the proposed works. Therefore, the DCO Proposed Development will have a negligible impact on GWDTE which are more than 1 km away.

Element Scoped Out	Stage of Work	Justification
Mine waters	Construction, Operation, Decommissioning	Mine water is considered to be a negligible risk to the DCO Proposed Development. A site walkover concluded that although a historic mine shaft was noted to be present a short distance north of proposed trenchless crossing TRS-41, there was no evidence of mine water being present on a site walkover. This was similarly the case for the abandoned mine shafts situated nearby to the proposed Alltami Brook crossing, with no evidence of mine water discharges being found on site walkovers. Additionally, the **Coal Mining Risk Assessment (presented in Appendix 11.2, Volume III)** stated that a geophysical survey was also conducted near to Wepre Brook (Alltami Brook) to determine if there were any voids near to the surface and none were observed from the data recovered. Further detail is provided in **paragraph 18.5.4**.

Construction Stage

18.4.5. The following surface water receptors have been scoped into the assessment because of their likelihood to interact with the DCO Proposed Development (in order from east to west). They are also shown on **Figure 18.1 – Watercourses (Volume IV):**

- Mersey Estuary Site of Special Interest (including Shellfish Water and Cockle Regulating Order)
- Manchester Ship Canal
- Glass Factory Ditch
- East Central Drain
- Elton Lane Ditch 1
- Elton Lane Ditch 2
- Elton Lane Ditch 4
- Elton Lane Ditch 6
- Elton Lane South Ditch
- Elton Marsh 1
- Elton Marsh 2
- Elton Marsh 3
- Elton Marsh 10
- Elton Marsh 11
- Elton Marsh 12
- Elton Marsh 13
- West Central Drain
- Hapsford Brook
- Elton Brook Tributary 1
- Gale Brook
- Thornton Uplands
- Halls Green Lane Brook
- Thornton Ditch 4
- Thornton Ditch 5
- Thornton Ditch 6
- Thornton Main Drain
- Thornton Ditch 3
- River Gowy
- Thornton Ditch 1
- Thornton Ditch 2
- Canal Ditch
- Collinge Wood Brook
- Rake Lane Brook
- Backford brook
- Friars Park Ditch
- Grove Road Ditch
- Gypsy Lane Brook
- Overwood Ditch
- Finchetts Gutter Tributary
- Seahill Tributary 2
- Seahill Drain
- Sealand Main Drain
- River Dee
- Dee Estuary Special Protection Area
- Hawarden Brook
- Railway Ditch 1
- Railway Ditch 2
- Broughton Brook
- Sandycroft Drain
- Chester Road Drain Tributary 1
- Chester Road Drain Tributary 2
- Mancot Brook
- Mancot Brook Tributary
- Oakfield Ditch 1
- Oakfield Ditch 3
- Chester Road Drain North
- Willow Park Brook
- Aston Hall Brook Tributary
- Aston Hall Brook
- New Inn Brook
- Alltami Brook

- Stanney Main Drain
- Stanney Mill Brook
- Gowy Tributary 2
- Wervin Hall Ditch Tributary
- Shropshire Union Canal
- Wepre Brook
- Northop Brook Tributary 2
- Northop Brook
- Northop Brook Tributary 1
- Little Lead Brook
- Nant-y-Fflint

18.4.6. The following groundwater receptors have been scoped into the assessment:

- Principal aquifers;
- Secondary A aquifers;
- Groundwater abstractions and Source Protection Zones within 1 km of the Newbuild Infrastructure Boundary;
- GWDTEs within 1 km of the Newbuild Infrastructure Boundary; and
- Surface water features which may have a significant groundwater baseflow component which could be impacted.

18.4.7. The following Flood Risk receptors have been scoped into the assessment:

- Residents and Users of the Surrounding Land; and
- Construction Workers.

Operation Stage

18.4.8. The following surface water receptors have been scoped into the assessment:

- East Central Drain;
- Alltami Brook;
- Canal Ditch;
- Overwood Ditch;
- Finchetts Gutter Tributary;
- Aston Hall Brook Tributary;
- Wepre Brook;
- Little Lead Brook;
- Nant-y-Fflint;
- Backford Brook;
- Friars Park Ditch; and
- Elton Lane Ditch 1.

18.4.9. The following groundwater receptors have been scoped into the assessment:

- Principal aquifers;
- Secondary A aquifers;

- Groundwater abstractions and Source Protection Zones within 1 km of the Newbuild Infrastructure Boundary; and
- GWDTEs within 1 km of the Newbuild Infrastructure Boundary.

18.4.10. The following Flood Risk receptors have been scoped into the assessment:

- Residents and Users of the Surrounding Land; and
- Operators and maintainers of the DCO Proposed Development.

Decommissioning Stage

18.4.11. The following surface water receptors have been scoped into the assessment:

- West Central Drain;
- East Central Drain;
- Manchester Ship Canal;
- Gale Brook;
- Little Lead Brook;
- River Gowy;
- Canal Ditch;
- Overwood Ditch;
- Aston Hall Brook Tributary;
- Wepre Brook;
- Nant-y-Fflint;
- Dee Estuary Special Protection Area; and
- Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and Cockle Regulating Order).

18.4.12. The following groundwater receptors have been scoped into the assessment:

- Principal aquifers;
- Secondary A aquifers;
- Groundwater abstractions and Source Protection Zones within 1 km of the Newbuild Infrastructure Boundary;
- GWDTE within 1 km of the Newbuild Infrastructure Boundary;
- Surface water features which may have a significant groundwater baseflow component which could be impacted; and
- Groundwater Source Protection Zones (SPZs).

18.4.13. The following Flood Risk receptors have been scoped into the assessment:

- Residents and users of the surrounding land; and
- Construction workers.

18.5. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

STUDY AREA

18.5.1. The Study Area for the assessment is the area within the Newbuild Infrastructure Boundary and 500m from the Newbuild Infrastructure Boundary for surface water elements and flood risk receptors. The Study Area also includes any watercourses which are 5km directly downstream of watercourses which will be potentially directly impacted by the DCO Proposed Development.

18.5.2. The relevant Study Area for flood risk receptors will be modified as appropriate based on the professional judgement of the assessor as part of the EIA, as flood risk influence area cannot be defined only based on distance. The receptors considered in the assessment of flood risk is explained in the Flood Risk Assessment and Flood Consequences Assessment **(Appendix 18.4 – FRA, Appendix 18.5 – FCA, (Volume III))**.

18.5.3. The Study Area for the **WFDa (Appendix 18.3 – WFDa, (Volume III))** includes all watercourses that fall within the WFD catchment boundary within the Newbuild Infrastructure Boundary and within 5km of the Newbuild Carbon Dioxide Pipeline, six BVSs and four AGIs, as well as WFD water bodies up to 5km directly upstream or downstream.

18.5.4. The Study Area for assessing the hydrogeological impacts is defined as the area within and up to 1km from the Newbuild Infrastructure Boundary. This distance is considered appropriate for the assessment of direct effects on groundwater receptors considering that the identified potential impacts are of localised or temporary nature.

METHOD OF BASELINE DATA COLLATION

Desk Study

18.5.5. Readily available information has been reviewed to understand the baseline data for the Newbuild Infrastructure Boundary. The following sources of information have been used:

- Environment Agency online Flood Map for Planning **(Ref. 18.33)**
- Environment Agency online Flood Risk from Surface Water map **(Ref. 18.34)**
- Environment Agency online Flood Risk from Reservoirs map **(Ref. 18.35)**
- Environment Agency Recorded Flood Outlines map **(Ref. 18.36)**
- Environment Agency online Catchment Data Explorer **(Ref. 18.37)**
- Environment Agency North West River Basin Management Plan **(Ref. 18.38)**
- Environment Agency River Dee Basin Management Plan **(Ref. 18.39)**
- NRW Dee River Basin Management Plan **(Ref. 18.40)**

- NRW Water Watch Wales **(Ref. 18.41)**
- NRW NBN Atlas Wales **(Ref. 18.42)**
- NRW Flood Risk Map Viewer **(Ref. 18.43)**
- NRW Flood Map for Planning **(Ref. 18.44)**
- Ordnance Survey Mapping **(Ref. 18.45)**
- Environment Agency LiDAR Digital Terrain Model **(Ref. 18.46)**
- DEFRA 'Magic Map' online GIS portal **(Ref. 18.47)**
- British Geological Survey (BGS) Geology of Britain Viewer **(Ref. 18.48)**
- BGS Geoindex online database **(Ref. 18.49)**
- Google maps, Aerial Imagery **(Ref. 18.50)**
- National Library of Scotland, Historical mapping **(Ref. 18.51)**
- Flood Estimation Handbook Web Service **(Ref. 18.52)**
- CWCC SFRA **(Ref. 18.53)**
- FRA - HyNet Low Carbon Hydrogen plant **(Ref. 18.54)**
- FRA and Surface Water Management plan **(Ref. 18.55)**
- Stanlow and Tranmere Flood Risk Management Scheme **(Ref. 18.32)**
- Ince and Frodsham Marshes Maintenance strategy study 2011 **(Ref.18.56)**
- Cheshire west and Chester Local Plan **(Ref. 18.22, Ref. 18.23)**
- FCC Preliminary Flood Risk Assessment **(Ref. 18.57)**
- Groundsure Enviro + Geo Insight Reports – Block Valves 1, 2 and 3/4 **(Annex B of Appendix 11.1 – Phase 1 Land and Soils (Contaminated Land) Baseline (Volume III)) (Ref. 18.58)**
- The Coal Authority Interactive Map Viewer **(Ref. 18.59)**

18.5.6. In addition to the above, the Environment Agency has provided WFD mitigation measures data to inform the WFDa and model outputs from the following models:

- Ince and Frodsham 2011;
- Mersey Tidal model;
- River Gowy model; and
- Tidal Dee model.

18.5.7. NRW has provided model outputs from the following models:

- Dee Tidal model;
- Point of Ayr to Pensam model;
- Queensferry model; and
- Wepre Brook model.

Site Visit and Surveys

18.5.8. Site visits have been carried out to inform the baseline assessment and advise on the design of the DCO Proposed Development.

18.5.9. The site visits included a general walkover of watercourses within the Study Area at the approximate location of proposed watercourse crossings as part of the DCO Proposed Development. Further detail on the proposed watercourse crossings is provided in **Section 18.6**. Photographs and notes were taken at these locations detailing general observations on water quality, flow dynamics, riparian quality, and geomorphological characteristics. No quantitative survey data was collected.

18.5.10. The proposed watercourse crossings in England were visited on the 13 and 14 October 2021. Conditions were dry and there had been some wet weather in preceding weeks. The proposed watercourse crossings in Wales were visited on the 2 and 3 November 2021. Conditions were dry during the survey, however there was heavy rain the weekend prior as well as overnight on the 2 November 2021. As a result, above average flows were observed and there was some flooding to adjacent fields at some watercourses. This is consistent with the flood mapping (**Ref. 18.33**).

18.5.1. A further set of site visits was carried out in April and May 2022 in order to collect River Condition Assessment data to inform Biodiversity Net Gain calculations. The full suite of results is presented in **Biodiversity Net Gain Report (Document reference: D.6.5.12).** Weather conditions varied across the weeks of surveying however there were no extreme events within this time which resulted in extreme river flow conditions.

18.5.2. Due to the inclusion of outfalls as part of the drainage strategy, additional River Condition Assessment field surveys were undertaken on 16 and 17 June 2022 on the following watercourses:

- Overwood Ditch; and
- Nant-y-Fflint.

18.5.3. Due to land access restrictions at the time of the surveys, Hawarden Brook has not been surveyed. This watercourse is within the Newbuild Infrastructure Boundary but is not crossed by the Newbuild Carbon Dioxide Pipeline, although may be crossed by a temporary crossing during construction.

18.5.4. A site walkover was undertaken in March 2022 with the aim of locating the abandoned mine entries shown on The Coal Authority's Interactive Map Viewer (**Ref. 18.59**) which were considered to represent a potential mine water risk. These were shown to be located within the land colloquially known as Lamb Farm. The area of concern is a small, forested area, also containing a mine spoil tip, situated immediately south of the farm compound, at approximate grid reference SJ 26376 67807. An abandoned mine entry was located on the

walkover, immediately south of the minespoil tip. No evidence of mine water risk was identified at or around the mine entries. The mine entries were dry, there was no evidence of any iron ochre present at the entries or in the immediate vicinity. The indicative alignment (for assessment) of the Newbuild Carbon Dioxide Pipeline and trenchless crossing TRS-41 (see **Figure 3.2 - DCO Proposed Development (Sheet 5) (Volume IV)**) is also situated to the south of the mine entry locations (~60 m distance). The stream watercourse flowing immediately to the south of the woodland, at approx. NGR SJ 26351 67622 (tributary to the Wepre Brook to the east) showed no evidence of any mine water inflow (i.e., ochreous discharges), nor were any located on a wider walkover of the woodland area surrounding the mine entry. Following the completion of this survey no further investigative work was undertaken to assess mine water risk.

18.5.5. Additionally, no mine water emergence was observed in the vicinity of Alltami Brook during site walkovers. Mine plans were included in the Coal Mining Risk Assessment (**Appendix 11.2 – Coal Mining Risk Assessment (Volume III)**), which indicate the former mine workings will be to the north of the Newbuild Infrastructure Boundary at Alltami Brook. Additionally, geophysical surveys found no evidence of void spaces. No further investigative work was undertaken to assess mine water risk.

A Ground Investigation (GI) was undertaken across the Newbuild Infrastructure Boundary from November 2021 through to March 2022. The GI involved trial pits, boreholes, CPT tests and groundwater monitoring between the Ince AGI and Flint AGI, while at the Cornist Lane BVS, Pentre Halkyn BVS and Babell BVS only trial pits were completed. Groundwater monitoring was undertaken at 11 locations along the Permanent Acquisition of Subsurface Area, which included continuous hourly measurements from diver data from 26 January 2022. The complete GI report is included as **Appendix 11.6 – Ground Investigation Report (Volume III).**

IMPACT ASSESSMENT METHODOLOGY

18.5.6. This assessment has assumed the worst case scenario for the location of the Newbuild Carbon Dioxide Pipeline within the Permanent Acquisition of Subsurface Area, regarding the assessment of the water environment and flood risk. For example, if the alignment could involve crossing a watercourse, it has been assessed as if this is the case. Similarly, the worst case scenario has been considered when assessing the impact of trenchless crossings.

Surface water quality, hydrology and hydromorphology

18.5.7. Impacts to water quality, hydrology, and hydromorphology have been assessed qualitatively for the Construction, Operational and Decommissioning Stages of the DCO Proposed Development. Assessing the effects of the Construction

Stage considers risks to the chemical and physico-chemical quality of surface water receptors associated with pollutants typically encountered during Construction and Decommissioning stages. The assessment of effects also considers risks to hydromorphological quality associated with changes to flow dynamics, cross-sectional profile, planform, connectivity, riparian zone and sediment load, transport, deposition, and erosion.

18.5.8. The assessment of potential impacts to the hydromorphological and hydrological regime of surface water features has been informed by desk-based study, field survey data, consultation with ecological specialists, and consultation with the relevant authorities. The assessment considers the impact of the DCO Proposed Development on catchment hydrology and flow dynamics in receiving watercourses.

Hydrogeology

18.5.9. The methodology of the groundwater impact assessments includes:

- Establishing baseline conditions (aquifer types, groundwater level and quality information) within the Study Area through review of desk-based sources of information, the GI, literature review and consultation with relevant authorities;
- Determining the anticipated groundwater receptors and their sensitivity;
- Assessment of predicted impact prior to mitigation measures and the residual effects once the expected mitigation measures are applied and
- Identifying opportunities for enhancements within the groundwater environment.

18.5.10. Impacts associated with maintenance activities during operation are considered to involve similar techniques to those during Construction and Decommissioning. Therefore, typical pipeline replacement works, if required in the future, are assumed to be similar to construction and therefore not specifically considered further.

18.5.11. Baseline conditions have been informed using publicly available information listed in **paragraph 18.5.5**. The Environment Agency and Natural Recourses Wales provided information on licenced abstractions, while the Local Authorities provided information on Private Water Supplies. Additional information has been obtained from the Groundsure Report (see **Annex B of Appendix 11.1 - Phase I Land and Soil (Contaminated Land) Baseline Report (Volume III)**). In addition to the desk study, intrusive GI provided site specific data on groundwater conditions.

Flood Risk

18.5.12. Changes in flood risk during the Construction, Operation and Decommissioning stages have been assessed qualitatively based on professional judgement and

any necessary mitigation has been identified and proposed to ensure that any potential flood risk for the DCO Proposed Development is managed and the proposals do not negatively affect flood risk within the area.

18.5.13. The potential impacts of flooding during construction have been assessed taking into account the location of the Construction Compounds and the methodology for construction. The assessment is presented in this Chapter.

18.5.14. For the Operational Stage, an **FRA** (**Appendix 18.4 - FRA (Volume III)**) and **FCA** (**Appendix 18.5 - FCA (Volume III)**) have been prepared to support the ES in accordance with the National Planning Policy Framework (NPPF) (**Ref. 18.17**) and Technical Advice Note 15, 2004 (TAN15) (**Ref. 18.25**). The FRA and FCA investigate all potential sources of flooding considering the expected effect of climate change and assess the potential implications of the DCO Proposed Development on flood risk to people and property in the area, as well as assess the potential risk of flooding to the DCO Proposed Development.

18.5.15. The studies have been informed by flood mapping produced by the Environment Agency and NRW (**Ref. 18.33, 18.34, 18.35, 18.36, 18.43, 18.44**) associated modelling information provided by those authorities and various strategic and site-specific studies identified as relevant for the assessment – no quantitative hydraulic modelling has been carried out. Engagement with the Environment Agency and NRW, have been undertaken; however, to date, detailed engagement with CWCC and FCC as LLFAs has been attempted but no response has been received from CWCC and only an introductory meeting has been held with FCC to date, as set out in **Table 18-1.** An opinion was received from both LLFAs on the EIA Scoping Report (**Appendix 1.1 - EIA Scoping Report (Volume III)).** A site visit has been carried out in areas where flood risk impact is possible.

18.5.16. The assessment has also considered, from a strategic perspective, any anticipated temporary drainage solutions which will be implemented during the Construction and Decommissioning Stages of the DCO Proposed Development.

18.5.17. For the Operational stage an **Outline Surface Water Drainage Strategy Report (Document reference: D.6.5.13**) has been developed for all relevant above ground infrastructure (for example, AGIs and BVSs), in compliance with local and national surface water management requirements produced by CWCC and FCC, to demonstrate the appropriate management of surface water runoff and the avoidance of any associated increase in flood risk at the sites and elsewhere.

Water Framework Directive

18.5.18. The impacts to the identified WFD water bodies have been assessed through a **WFDa (Appendix 18.3 – WFDa (Volume III)),** following the guidance

methodology outlined in The Inspectorate Guidance Note 18 (**Ref. 18.27**). A WFD screening assessment was carried out which identified the WFD water bodies which will be screened in for assessment. This was presented to the Environment Agency and NRW, on 2 March 2022 and 7 February 2022, respectively, and subsequently agreed. A screening assessment of activities was also carried out; however, this has partly become redundant given changes in the design since these meetings. The screening of activities has been updated with the recent design changes and this is presented in the WFDa.

18.5.19. A scoping exercise has been completed which considers which WFD quality elements need to be scoped in for detailed assessment based on the potential impacts stemming from each screened-in activity of the DCO Proposed Development.

18.5.20. The potential impacts of screened-in activities to scoped-in quality elements have been assessed. Assessment has been qualitative using desk-based and field survey data and has been informed by the results of the **FRA** (**Appendix 18.4 (Volume III)**) and **FCA** (**Appendix 18.5 (Volume III)**), as well as groundwater and aquatic ecology assessments undertaken to inform this Chapter. The WFDa has also been informed by the River Condition Assessment and associated enhancements required to achieve the BNG target set for the DCO Proposed Development. The assessment also identified whether any mitigation is required (as part of the DCO Proposed Development) in order to prevent significant impacts on the WFD status of the identified water bodies.

SIGNIFICANCE CRITERIA

18.5.21. The assessment methodology used in this Chapter builds on and adapts the classification contained in LA 113 Road Drainage and the Water Environment **(Ref. 18.30)** and the TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment (**Ref. 18.29)**.

18.5.22. The above guidance was developed for assessing potential impacts that road projects may have on the water environment; however, the guidance provides a suitable framework and basis to develop a consistent classification of both magnitude of impact and sensitivity of potential water receptors and is generally considered as industry best practice.

18.5.23. This method will not be applied for the WFDa as it has a specific assessment methodology. The WFDa follows the methodology guidance set out in the Planning Inspectorate Advice Note Eighteen: The Water Framework Directive **(Ref. 18.27)** and NRW's Operational Guidance Note 072 **(Ref. 18.31).**

18.5.24. Agreement on the usage of the LA 113 Road Drainage and the Water Environment **(Ref. 18.30)** and the TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment **(Ref. 18.29)** assessment methodologies

for assessing impacts to groundwater (in terms of assigning significance and magnitude) has been sought from the relevant consultation bodies, with responses still outstanding at the time of writing.

Determining Sensitivity of Receptors

18.5.25. The criteria used to determine the sensitivity of each receptor is presented in **Table 18.3**. Please note that for flood risk, no 'High' category is proposed. This is because, based on our experience, differentiating in a consistent way between 'high' and 'very high' sensitivity of receptors will require a level of detail excessive compared to the large scale of the study and provide negligible benefit. As a precautionary approach residents and users of the surrounding areas are all considered as having a 'very high' sensitivity rather than 'high'.

Determining Magnitude of Impacts

18.5.26. The criteria used to determine the magnitude of impacts is presented in **Table 18.4.** The criteria used is based upon the guidance provided in the Design Manual for Roads and Bridges (LA113) (**Ref. 18.30**) and is applicable to linear infrastructure schemes.

Table 18.3 - Criteria for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition of Magnitude	Typical Examples
Very High	Nationally significant attribute of high importance	• Watercourse having a WFD classification shown in a RBMP and with Q95 > 1m^3/s. • Site protected / designated under EU or UK habitat legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site, salmonid water), or species protected by EC Legislation Ecology and Nature Conservation. • Groundwater Source Protection Zone (SPZ) 1. • Groundwater locally supports a Ground Water Dependent Terrestrial Ecosystem (GWDTE) or any other very significant feature • Principal aquifer providing a regionally important resource or protected site. • Essential infrastructure, highly vulnerable and more vulnerable development (as defined in Table 2 of the Flood Risk technical guidance section of the NPPF) and associated users, including residents.
High	Locally significant attribute of high importance	• Watercourse having a WFD classification shown in a RBMP and with Q95 < 1m^3/s. • Species protected under EC or UK Legislation Ecology and Nature Conservation. • Groundwater SPZ 2. • Groundwater supports a GWDTE or any other significant feature. • Principal aquifer providing locally important resource or supporting a river ecosystem.
Medium	Moderate quality and rarity	• Watercourse not having a WFD classification shown in a RBMP and with Q95 > 0.001m^3/s. • Aquifer providing water for agriculture or industrial use with limited connection to surface water. • Groundwater SPZ 3. • Less vulnerable development (as defined in Table 2 of the Flood Risk technical guidance section of the NPPF) and associated users for example office employees. This category also includes construction workers as their sensitivity is reduce by training received and working hours.
Low	Lower quality	• Watercourse not having a WFD classification shown in a RBMP and with Q95 < 0.001m^3/s. • Unproductive strata.

Table 18.4 - Criteria for Determining Magnitude of Impact

Level of Magnitude	Definition of Magnitude	Typical Examples
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	• Loss or extensive change to a fishery. • Loss or extensive change to a designated nature conservation site. • Loss of regionally important public water supply. • Reduction in WFD classification. • High likelihood of pollution from solubles and sedimentation. • Risk of pollution from spillage >2% annually. • Loss of, or extensive change to, an aquifer. • Potential high risk of pollution to groundwater from routine runoff. • Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. • Loss or significant damage to major structures through subsidence or similar effects. • A substantial increase in the likelihood, depth, or extent of flooding as a consequence of the DCO Proposed Development (existing receptors) sufficient to put life at risk. • High probability/risk of flooding potentially affecting receptors introduced as part of the DCO Proposed Development, sufficient to put life at risk. • Large increase in discharge in sewerage network combined with significant capacity issues of the network.

Level of Magnitude	Definition of Magnitude	Typical Examples
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	• Partial loss in productivity of a fishery. • Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. • Contribution to reduction in WFD classification. • Moderate likelihood of pollution from solubles and sedimentation. • Risk of pollution from spillage <2% annually. • Partial loss or change to, an aquifer. • Potential high risk of pollution to groundwater from routine runoff. • Partial loss of the integrity of GWDTE. • Damage to major structures through subsidence or similar effects or loss of minor structures. • Some increase in the likelihood, depth, or extent of flooding as a consequence of the DCO Proposed Development (existing receptors) which can cause significant damage but is not expected to put life at risk. • Medium probability/risk of flooding potentially affecting receptors introduced as part of the DCO Proposed Development, which can cause significant damage but is not expected to put life at risk. • Medium increase in discharge in the sewerage network combined with some lack of capacity of the network.
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	• Moderate likelihood of pollution from either solubles or sedimentation. • Risk of pollution from spillage <1% annually. • Minor effects on water supplies. • Potential high risk of pollution to groundwater from routine runoff. • Minor effects on an aquifer, GWDTEs, abstractions and structures. • Measurable but limited in size or magnitude increase in the probability, depth or extension of flooding (existing receptors). • Measurable but limited probability/risk of flooding potentially affecting receptors introduced as part of the development.

Level of Magnitude	Definition of Magnitude	Typical Examples
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	• The proposed project is unlikely to affect the integrity of the water environment. • No risk to water quality from solubles or sedimentation. • Risk of pollution from spillage <0.5% annually. • No measurable impact upon an aquifer and/or groundwater receptors. • Negligible change in flood risk as a consequence of the development (existing receptors)/negligible flood risk affecting receptors introduced as part of the development.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	• Reduction in baseline pollution from either solubles or sedimentation. • Reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually). • Reduction of groundwater hazards to existing structures. • Reductions in waterlogging and groundwater flooding. • Measurable but limited in size or magnitude reduction in the probability, depth, or extension of flooding (existing receptors).
Moderate Beneficial	Results in moderate improvement of attribute quality	• Reduction in baseline pollution from both solubles and/or sedimentation. • Reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually). • Contribution to improvement in WFD classification. • Improvement in water body catchment abstraction management strategy classification. • Support to significant improvements in damaged GWDTE. • Some reduction in the likelihood, depth, or extent of flooding as a consequence of the DCO Proposed Development (existing receptors) which is expected to cause a significant reduction in the potential damage caused by flooding. • Medium reduction in discharge in sewerage network providing some improvement in capacity.

Level of Magnitude	Definition of Magnitude	Typical Examples
Major Beneficial	Results in major improvement of attribute quality	• Removal of existing pollution from solubles and sedimentations. • Improvement in WFD classification. • Recharge of an aquifer. • A substantial reduction in the likelihood, depth or extent of flooding as a consequence of the DCO Proposed Development (existing receptors) sufficient to reduce risk to life. • Large reduction in discharge into the sewerage network freeing up significant capacity
No change		• No loss or alteration of characteristics, features, or elements; no observable impact in either direction.

Determining Significance of Effect

18.5.27. The combination of receptor sensitivity and magnitude of impact has been used to determine the significance of each effect by using the matrix in **Table 18.5**. This matrix is based on that provided in Table 3.8.1 of the DMRB LA 104 (**Ref. 18.60**).

18.5.28. Effects which are moderate or above are considered to be significant.

Table 18.5: Significance Matrix

Sensitivity of Receptor	Magnitude of Impact				
	Major	**Moderate**	**Minor**	**Negligible**	**No Change**
Very High	Very Large	Large	Moderate	Slight	Neutral
High	Large	Moderate	Slight	Slight	Neutral
Medium	Moderate	Moderate	Slight	Neutral	Neutral
Low	Slight	Slight	Neutral	Neutral	Neutral

ASSUMPTIONS AND LIMITATIONS

18.5.29. Access to Hawarden Brook or Canal Ditch was not possible and therefore no site-specific baseline data is available for these watercourses.

18.5.30. A high level WFD screening and scoping conclusion has been presented to the Environment Agency and NRW which has been agreed and used as a basis for the WFD assessment methodology. This has since been refined through the development of the design which has not been agreed with either regulator, although detailed discussions have been held with NRW regarding the proposed works at Alltami Brook.

18.5.31. There has been engagement with CWCC and FCC in their roles as LLFA, however, at the time of writing, the LLFAs have not yet provided their responses to the enquiries. The drainage strategy (**Outline Surface Water Drainage Strategy Report, Document reference: D.6.5.13**) and the **FRA (Appendix 18.4 (Volume III))** and **FCA (Appendix 18.5 (Volume III))** are in accordance with national policy and also local policy when found readily available. Impacts and mitigation for the Alltami Brook have been discussed with NRW; however, as this is an ordinary watercourse, it will be the LLFA who consent to the work. It is assumed that guidance from NRW will be relevant to this watercourse crossing.

18.5.32. Walkover surveys were completed along watercourses at the assumed crossing locations along the indicative alignment of the Newbuild Carbon Dioxide Pipeline as shown on **Figure 3.2 - DCO Proposed Development (Sheets 1 to 6)** (**Volume IV)**. The Newbuild Carbon Dioxide Pipeline will be located anywhere within the Permanent Acquisition of Subsurface Area. Therefore, not all possible crossing locations have been surveyed. It should be noted that in most cases, the watercourses are fairly uniform and that potential impacts are likely similar across all possible crossing locations on these watercourses.

18.5.33. Where there are changes in watercourse character within the Permanent Acquisition of Subsurface Area, refinement and localised re-routing of the proposed watercourse crossing by the Construction Contractor is recommended during Detailed Design in order to minimise potential adverse effects to watercourses.

18.5.34. The Environment Agency provided groundwater level data and groundwater level contours, and historical borehole records were provided publicly by the BGS. This information was used to supplement the groundwater level information from the GI data where it was considered necessary to do so. It should be noted that this historic data may not be representative of current conditions. Reasonable worst-case water level assumptions were made for the assessments.

18.5.35. The assessment of flood risk has been undertaken using readily available information including strategic studies (e.g. SFRAs), through consultation with key stakeholders and a review of the hydraulic modelling information provided by the Environment Agency and NRW. No hydraulic modelling has been undertaken to inform the assessment.

18.6. BASELINE CONDITIONS

EXISTING BASELINE

Surface Water

18.6.1. There are 18 main rivers within the Newbuild Infrastructure Boundary, namely:

- East Central Drain;
- West Central Drain;
- Hapsford Brook;
- Gale Brook;
- Thornton Uplands;
- Thornton Main Drain;
- River Gowy;
- Stanney Main Drain;

- Stanney Mill Brook;
- Backford Brook;
- Seahill Drain;
- Sealand Main Drain;
- River Dee;
- Hawarden Brook;
- Broughton Brook;
- Sandycroft Drain;
- Chester Road Drain Tributary 1; and
- Chester Road Drain North.

18.6.2. The DCO Proposed Development will also cross the Shropshire Union Canal. Main rivers and the canal are shown in **Figure 18.1 - Watercourses (Volume IV).**

18.6.3. In addition, there are 51 ordinary watercourses located within the Newbuild Infrastructure Boundary, including New Inn Brook, Alltami Brook, Wepre Brook, Northop Brook and Nant-y-Fflint.

18.6.4. Further information on these main rivers and ordinary watercourses is presented in Sections 2 and 3 of **Appendix 18.1 – Baseline Information (Volume III).**

18.6.5. There are 249 ponds located within 250m of the Newbuild Infrastructure Boundary, of which 48 ponds are located within the Newbuild Infrastructure Boundary. These 48 ponds provide very local land drainage use; many are located within fields or at field boundaries. They are likely to be ephemeral with their value in the habitat they provide for biodiversity.

18.6.6. The Dee Estuary SPA Area and Mersey Estuary SSSI are located within 5km directly downstream of all watercourses crossed by the DCO Proposed Development.

18.6.7. There are 12 licenced discharges to controlled surface waters within 500m of the Newbuild Infrastructure Boundary, within England, all of which are discharges of treated effluent from private properties or sewer storm overflows owned by water companies. There are no licenced discharges within the Newbuild Infrastructure Boundary.

18.6.8. There are four licenced surface water abstractions in England, and three licenced surface water abstractions in Wales, within 5km downstream of the Newbuild Infrastructure Boundary, which are presented in **Table 18-6.**

Table 18.6 - Licenced surface water abstractions downstream of the Newbuild Infrastructure Boundary

Licence number	Country	Water body	Description	Maximum annual quantity (litres)
2568006091	England	Shropshire Union Canal	Industrial, commercial, or public services	27,270
2568006113	England	River Gowy	Industrial, commercial, or public services – refuse and recycling	2,186,670
NW/068/0006/016	England	Thornton Brook	Industrial, commercial, or public services – hydraulic testing	41,500
NW/068/0006/004	England	River Gowy	Environmental improvements	No amount published.
WA/067/0010/011	Wales	Not provided	Agriculture	67,962,700
24/67/10/0080	Wales	Pandy Brook at Pentre Ffwrndan	Industrial, Commercial, Public Services	123,878,500
24/67/10/0079	Wales	Okenholt Reservoir	Industrial, Commercial, Public Services	626,211,500

Groundwater - Geology and hydrogeology

18.6.9. This section outlines the existing superficial and bedrock geologies which underly the DCO Proposed Development (divided into sections due to the localised detail) using the BGS GeoIndex and historic borehole logs **(Ref. 18.49)** and the GI results. In addition to the geological descriptions, the hydrogeology of each aquifer is described using information from the Environment Agency **(Ref. 18.47)**, BGS **(Ref. 18.61)** and relevant literature.

18.6.10. The paragraphs below first describe the superficial deposits present within each Section shown on **Figure 18.2– Superficial and Bedrock Geology (Sheets 1-3) (Volume IV)**, and then immediately the hydrogeology of the superficial deposits within that section, from east to west along DCO Proposed Development. The text then describes the bedrock geology and hydrogeology, again for each Section shown on **Figure 18.2 - Superficial and Bedrock Geology (Volume IV)** (also from east to west). The below paragraphs on geology and hydrogeology should be read in conjunction with **Figure 18.2 - Superficial and Bedrock Geology (Volume IV).**

Section 1 **(Figure 18.2 - Superficial and Bedrock Geology (Sheet 1) (Volume IV))**

18.6.11. BGS mapping indicates the superficial deposits that underlie Section 1 of the DCO Proposed Development are the tidal flat deposits, glacial Devensian till deposits and alluvium deposits **(Ref. 18.61)**. The tidal flat deposits are found underlying the Ince AGI and extend inland in a south-west direction towards Ash Road. These deposits comprise unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit and are normally a consolidated soft silty clay, with layers of sand, gravel and peat **(Ref. 18.61)**. The tidal flat deposits have been classified by the Environment Agency **(Ref. 18.67)** and BGS GeoIndex **(Ref. 18.49)** as Secondary (undifferentiated) aquifers, described as a layer not attributed to either category A or B rock type but which is typically less productive than a Secondary A aquifer. Borehole logs from the GI data has indicated that the tidal flat deposits are present between 0 – 10 meters below ground level (mbgl), below which glacial deposits are found.

18.6.12. To the south-west of Ash Road, the Newbuild Carbon Dioxide Pipeline and Stanlow AGI are underlain by glacial Devensian till, boulder clay which consists of poorly sorted material, predominantly fine-grained but ranging in grain size from clay to boulders (**Ref. 18.61**). The glacial Devensian till deposits have been classified by the Environment Agency (**Ref. 18.47**) and BGS GeoIndex (**Ref. 18.61**) as Secondary (undifferentiated) aquifers. At the Chester Services area, the GI has recorded the glacial deposits to a depth of approximately 15 mbgl before meeting bedrock. However, westwards at Thornton le Moors the till is thinner, with the GI data recording it at a depth of only 3-4 mbgl before meeting bedrock.

18.6.13. Along the Gale Brook at the Stanlow AGI alluvium deposits are present which comprise unconsolidated detrital material ranging from clay to gravel, sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta (**Ref. 18.58**). The alluvium deposits have been classified by the Environment Agency (**Ref. 18.67**) and BGS GeoIndex (**Ref. 18.61**) as a Secondary A aquifer, described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers.

18.6.14. BGS mapping indicates that the bedrock geology underlying the eastern region of Section 1 at the Ince AGI is the Kinnerton Sandstone Formation of the Sherwood Sandstone Group (SSG) (**Ref. 18.63**), which is present until the DCO Proposed Development crosses the A5117 road. The Kinnerton Sandstone is dominantly aeolian, consisting of red-brown to yellow sandstone, generally pebble-free, fine- to medium-grained and cross-stratified (**Ref. 18.58**). The Kinnerton Sandstone Formation forms part of the Sherwood Sandstone aquifer (SSG) along with the Chester Formation and Wilmslow Sandstone Formation

which are all in hydraulic continuity (**Ref. 18.62**). The SSG has been classified by the Environment Agency (**Ref. 18.67**) and BGS GeoIndex (**Ref. 18.61**) as a Principal aquifer. The three constituent formations of the SSG have similar upper and lower limits of Hydraulic Conductivity (K). The more cemented and finer grained Chester Formation contributes more to the lower K values while the Kinnerton Sandstone Formation and Wilmslow Sandstone Formation contribute more to the higher K values (**Ref. 18.63**). The BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.64**) describes the porosity of the SSG to range between 20-30%, but in places may be significantly lower relative to K values due to water flowing along fissures and faults which are fed by the intergranular pores. Literature states that recharge to the sandstone aquifer occurs through the permeable drift, with small contribution from the limestones to the west (**Ref. 18.63**). The GI data did not encounter the Kinnerton Sandstone Formation in any boreholes, BGS historic borehole SJ47NE19 encountered the sandstone at a depth of 85 mbgl (**Ref. 18.61**).

18.6.15. To the west of the A5117 the Newbuild Carbon Dioxide Pipeline and Stanlow AGI are underlain by the Chester Formation of the SSG. The Chester Formation consists of conglomerates and reddish brown, cross-bedded, pebbly sandstones with subordinate beds of red-brown mudstone. The conglomerates have a reddish-brown sandy matrix and consist mainly of pebbles of brown or purple quartzite, with quartz conglomerate and vein quartz (**Ref. 18.61**). As part of the SSG, the Chester Formation is a Principal aquifer. The GI data has indicated that the Chester Formation is deeper around the Chester Services area at approximately 15 mbgl and shallower at Thornton le Moors at approximately 3 – 4 mbgl.

Section 2 (**Figure 18.2 - Superficial and Bedrock Geology (Sheet 1) (Volume IV))**

18.6.16. The superficial deposits consist of glacial Devensian till (described in **paragraph 18.6.12**) from the Stanlow AGI, west to Wimbolds Trafford. From the Stanlow AGI until the M56, the GI has recorded the glacial deposits at between 4-7 mbgl before meeting bedrock. While west of the River Gowy around the M53 the glacial deposits are deeper proven to a depth of 20 mbgl.

18.6.17. Alongside the River Gowy, peat and blown sand deposits are present. The blown sand deposits comprise low rounded ridges of coarse materials (gravels, cobbles and boulders) piled up by very powerful storm waves at the inland margin of a beach, above the level reached by normal spring tides. Where the DCO Proposed Development crosses the Shropshire Union Canal, tidal flat and glaciofluvial deposits are present. The glaciofluvial deposits consists of coarse-grained sediments (sand and gravel) with some finer-grained lenses of silt, clay or organic material. The blown sand and glaciofluvial deposits have been classified by the Environment Agency (**Ref. 18.67**) and BGS GeoIndex (**Ref.**

18.61) as Secondary A aquifers. The BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.63**) has described the sand and gravels of the blown sand, glaciofluvial and head deposits as significant local resources where they overlie impermeable deposits, or the main aquifer is at considerable depth. Sands and gravels which overlie an aquifer are an important means of recharge to the aquifer both directly and indirectly by providing hydraulic continuity. Quality is variable and susceptible to contamination (**Ref. 18.63**). Peat has been described by the BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.63**) as a non-aquifer but can store considerable volumes of water which may be released either as baseflow or groundwater recharge (**Ref. 18.63**).

18.6.18. The GI has indicated that the blow sands deposit is thin, between 1-3 mbgl. The glaciofluvial deposits have been recorded to a depth of 9 mbgl before meeting bedrock. To the west of the Rock Bank BVS, glacial Devensian till is present towards the proposed Trenchless Crossing Compounds at A41, with the GI recording it to a depth of 6-7 mbgl before meeting bedrock.

18.6.19. The bedrock geology in Section 2 of the DCO Proposed Development consists predominantly of the Chester Formation (described in **paragraph 18.6.15**), with a small area underlain by the Wilmslow Sandstone Formation of the SSG near Thornton Green Lane. The Wilmslow Sandstone Formation comprises red-brown to brick-red, fine- to medium-grained, generally pebble-free, cross-bedded sandstones, with sporadic siltstones (**Ref. 18.61**). As part of the SSG, the Wilmslow Sandstone Formation is a Principal aquifer. The GI has recorded the Chester Formation at 8 mbgl west of Thornton le Moors before deepening below the superficial deposits, which have been proven to a depth of 20 mbgl across the River Gowy and M53. The sandstone then shallows around the Shropshire Union Canal with it outcropping on the western side of the canal.

Section 3 **(Figure 18.2 - Superficial and Bedrock Geology (Sheet 1) (Volume IV))**

18.6.20. To the west of the A41, the superficial deposit that underlies the DCO Proposed Development is the Devensian till (described in **paragraph 18.6.12**) westwards until approximately 300 m before the Chester Railway Path; beyond the path tidal flat deposits (described in **paragraph 18.6.11**) are present. The GI has proven the glacial till to a depth of 15 mbgl across Section 3, while the tidal flat deposits have been proven to a depth of 18 mbgl when approaching the River Dee.

18.6.21. The bedrock geology of Section 3 of the DCO Proposed Development consists of the Chester Formation (described in **paragraph 18.6.15**) in the east until the Mollington BVS. To the west of the BVS the DCO Proposed Development is underlain by Kinnerton Sandstone (described in **paragraph 18.6.14**). The bedrock formations where not proven by the GI in Section 3, with the superficial

deposits proven to a depth of 18 mbgl. However, BGS historic borehole SJ36NE12 has recorded soft sandstone at a depth of 21 mbgl at Mollington.

Section 4 **(Figure 18.2 - Superficial and Bedrock Geology (Sheet 1) (Volume IV))**

18.6.22. The superficial deposit which underly the DCO Proposed Development from the Chester Railway Path west across the River Dee to Chester Road are the tidal flat deposits (described in **paragraph 18.6.11**). To the west of Chester Road Devensian till deposits (described in **paragraph 18.6.12**) are present. From the western side of the River Dee to Sandycroft the GI has recorded the tidal flat deposits to a depth of 12-18 mbgl, underlain by glacial till. While the glacial till deposits west of Chester Road have been proven to a depth of 10 mbgl.

18.6.23. The bedrock geology which underlies the eastern region of Section 4, from Sealand Road to the railway line west of River Dee, consist of the Kinnerton Sandstone (described in **paragraph 18.6.14**). To the west of the railway line, the bedrock below the DCO Proposed Development consists of a faulted sequence of the Etruria Formation and Pennine Coal Measures Group. The Etruria Formation comprises red, purple, brown, ochreous, green, grey and commonly mottled mudstone, with lenticular sandstones and conglomerates (**Ref. 18.61**). The Etruria Formation has been classified by the Environment Agency (**Ref. 18.67**) as a Secondary A aquifer. The Etruria Formation has been described as a poorly productive formation (**Ref. 18.65**).

18.6.24. The Pennine Coal Measures Group consists of the Middle and Lower Coal Measures, an alternation of sandstone, grey siltstone and grey mudstone, with frequent coal seams and seatearth horizons (**Ref. 18.61**). The Pennine Coal Measures Group has been classified by the Environment Agency (**Ref. 18.67**) and BGS GeoIndex (**Ref. 18.61**) as a Secondary A aquifer. The Pennine Coal Measures Group has been described (**Ref. 18.65**) as having limited lateral recharge due to the fact that aquifer hydraulic continuity is restricted by extensive faulting, splitting the aquifer into isolated blocks. The BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.63**) describes the Coal Measures as being well-cemented sandstones with very low primary permeabilities. However, water occurs in the sandstones to depths of about 250 m both in joints and in the many fractures caused by mining subsidence (**Ref. 18.63**).

18.6.25. The bedrock formations where not recorded by the GI in Section 4, with the superficial deposits proven to over 17 mbgl. However, BGS historic borehole SJ36NW8 has recorded the coal measures at 50 mbgl in Sandycroft.

Section 5 **(Figure 18.2 - Superficial and Bedrock Geology (Sheet 2) (Volume IV))**

18.6.26. To the west of Mancot at Aston Hill BVS, the superficial deposits which underly the DCO Proposed Development until Holywell Road consist of the glaciofluvial deposits (described in **paragraph 18.6.17**) and Devensian till (described in **paragraph 18.6.12**). At Holywell Road a small, isolated pocket of head deposit is found. Head deposits comprise poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope and deposited by solifluction and gelifluction processes (**Ref. 18.49**). Head deposits have been classified by the Environment Agency (**Ref. 18.67**) and BGS GeoIndex (**Ref. 18.61**) as a Secondary A aquifer. At Aston Hill the GI has recorded the superficial deposits between 5- 10 mbgl with small pockets of glacial till that reach a depth of 20 mbgl. West of Aston Hill the remainder of Section 5 is underlain by glacial till which has been recorded by the GI to a depth of 5 – 10 mbgl before it meets bedrock.

18.6.27. From Colliery Lane west to the Aston Hill BVS, the bedrock geology that underlies the DCO Proposed Development consists of the Pennine Coal Measures Group. To the west of the Aston Hill BVS the Millstone Grit Group is present. The Millstone Grit consists of fine-grained, feldspathic and micaceous sandstones, cross-stratified on a variety of scales, with conglomerate-lined scours and intercalated siltstone and mudstone beds (**Ref. 18.61**). The Millstone Grit Group has been classified by the Environment Agency (**Ref. 18.67**) as a Secondary A aquifer. The Millstone Grit Group has been described (**Ref. 18.65**) as strata that act as a multi-layered aquifer system, with the impermeable mudstones and shales acting as aquicludes between the sandstone horizons which behave as separate aquifer units. The sandstones are generally well cemented and have little primary porosity or permeability, and groundwater storage and movement are mainly dependent on the presence of fractures. The BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.64**) states that the Millstone Grit Group has groundwater associated with joints and fissures within the rock, springs are present where jointed and inclined sandstone meet underlying less permeable shales surface.

18.6.28. Where the DCO Proposed Development crosses the A494 the Bowland Shale Formation of the Craven Group is present. The formation comprises mainly dark grey fissile and blocky mudstone, weakly calcareous, with subordinate sequences of interbedded limestone and sandstone, fossiliferous in more-or-less discrete bands (**Ref. 18.61**). The Bowland Shale Formation and Pentre Chert Formation make up the Craven Group aquifer in the DCO Proposed Development, which has been classified by the Environment Agency (**Ref. 18.67**) as a Secondary undifferentiated aquifer. The Craven Group aquifer has been described as a layer not attributed to either category A or B rock type which is typically less productive than a Secondary A aquifer. The Bowland

Shale Formation has been described as strata that acts as a multi-layered aquifer system, with the impermeable mudstones and shales acting as aquicludes between the sandstone and limestone horizons which behave as separate aquifer units (**Ref. 18.63**).

18.6.29. Westwards across Section 5, the DCO Proposed Development passes across a faulted sequences of sandstone beds of the Pennine Coal Measures Group, the Millstone Grit Group and the Etruria Formation. The Northop Hall AGI is underlain by the sandstone beds of the Pennine Coal Measures Group. The GI has indicated that bedrock is between 2.5 -10 mbgl between Pentre and Northop Hall with smaller pockets where bedrock is deeper due to thicker superficial cover (15 m) such as at Aston Hill. While westward the superficial cover is thicker with the superficial deposits being proven to over 15 mbgl.

Section 6 **(Figure 18.2 - Superficial and Bedrock Geology (Sheets 2 and 3)(Volume IV))**

18.6.30. From Connah's Quay Road until the Flint AGI, the superficial deposits which underly the DCO Proposed Development consist of the Devensian till (described in **paragraph 18.6.12**). To the east of the Flint AGI and alongside the existing pipeline, pockets of glaciofluvial and head deposits are present. The GI has proven the glacial deposits across Section 6 to a depth of 14 mbgl.

18.6.31. The bedrock geology which underlies Section 6 of the DCO Proposed Development consist of the Pennine Coal Measures Group (described in **paragraph 18.6.24**), and the Millstone Grit Group (described in **paragraph 18.6.27)**. The Flint AGI is underlain by the Pennine Coal Measures Group where it then connects to the Flint Connection to PoA Terminal Pipeline. The bedrock formations where not proven by the GI in Section 6, with the superficial deposits proven to over 14 mbgl. However, BGS historic borehole SJ26NE1635 has recorded the coal measures at 50 mbgl to the north of Northop Brook.

Section 7 (**Figure 18.2 Superficial and Bedrock Geology (Sheet 3) (Volume IV))**

18.6.32. The three BVSs along the Flint Connection to PoA Terminal Pipeline are underlain by superficial glacial deposits as recorded by the GI data. The Cornist Lane BVS is underlain by Devensian till (described in **paragraph 18.6.12**) proven to a depth of 2.7 mbgl, the Pentre Halkyn BVS is underlain by glaciofluvial deposits (described in **paragraph 18.6.17)** and Devensian till proven to a depth of 2.10 mbgl, and the Babell BVS is underlain by glaciofluvial and head deposits (described in **paragraph 18.6.17**) proven to a depth of 2.30 mbgl.

18.6.33. The bedrock geology that underlies the Cornist Lane BVS comprises the Bowland Shale Formation (described in **paragraph 18.6.28**), while the Pentre Halkyn BVS and Babell BVS are underlain by the Clwyd Limestone Group. The

group consists of a diverse range of limestone facies with subordinate sandstone and mudstone units and exhibit local dolomitization (**Ref. 18.61**) The Clwyd Limestone Group has been classified by the Environment Agency (**Ref. 18.67**) and BGS GeoIndex (**Ref. 18.61**) as a Principal aquifer, described as layers of rock or drift deposits that have high intergranular and/or fracture permeability meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. The BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.64**) states that the Carboniferous Limestone Series has very low porosities and intergranular permeabilities, yields from the matrix of the rock are minimal. However, the dissolution of the limestone has led to extensive karst features where groundwater moves through enlarged fissures, often controlled by faults. Although fissures are relatively sparse, they tend to be large and groundwater flows can therefore be rapid.

18.6.34. Only trial pits exist at the BVS locations for the GI at the time of writing, so the depth to bedrock could not be proven. There are no nearby BGS records for Cornist Lane or Pentre Halkyn BVS, however BGS historic borehole SJ17SE124 400m east of Babell BVS indicates bedrock is at 3.5 mbgl.

Groundwater levels and flows

Section 1, Section 2, Section 3 and Section 4

18.6.35. The GI results have recorded groundwater levels at multiple locations within the Newbuild Infrastructure Boundary, from the Ince AGI to the River Dee. The results include diver data from groundwater monitoring locations (groundwater levels / elevations with a max-min range in **Table 18.7**) and manual spot measurements of water levels recorded after 20 minutes of a water strike (single measurements in **Table 18.7**). The groundwater observations are summarised in **Table 18.7** and illustrated on **Figure 18.2 – Superficial and Bedrock Geology (Volume IV).**

Table 18.7 - Groundwater levels from Section 1 to Section 4

ID	Location (Section)	Easting	Northing	Groundwater Level (mBGL)	Groundwater Elevation (mAOD)
CPT202	At Ince AGI connection (Section 1)	346913	376122	0.4	2.6
CPT213	South of Ince AGI entry (Section 1)	346956	375920	1.0	2
BHCPT203	200 m south of Ince AGI (Section 1)	346965	375748	1.1	1.9

ID	Location (Section)	Easting	Northing	Groundwater Level (mBGL)	Groundwater Elevation (mAOD)
CPT210	200 m northeast of the indicative alignment of the Newbuild Carbon Dioxide Pipeline, alongside B5132 (Section 1)	345115	374611	0.9	8.1
BH02	200m southwest of Stanlow AGI (Section 1)	344527	374759	3.2 - 3.7 (18/02/2022 – 11/02/2022)	6 – 6.6
BH05	Alongside M56 crossing, (Section 2)	344682	373573	3.0 – 3.7 (18/02/2022 – 28/01/2022)	6.6 – 7.3
BH114	100 m south of indicative alignment of the Newbuild Carbon Dioxide Pipeline, north of Halls Green Lane (Section 2)	344516	373307	-0.1 – 0.3 (15/12/2021 – 21/12/2021)	7.8 – 7.4
CPT10	To the east of River Gowy, along indicative alignment of the Newbuild Carbon Dioxide Pipeline (Section 2)	343654	372905	0.5	5.5
BH19	40m east of the Shropshire Union Canal (Section 2)	341492	371134	1.35 – 1.74 (29/03/2022)	10.93 – 10.54
BH32	At Townfield Lane (Section 3)	338280	370507	3.65 (22/11/2021)	29.35
BH44	On the north eastern bank of the River Dee, along indicative alignment of the Newbuild Carbon Dioxide	334879	367161	2.2 – 3.6 (16/11/2021 – 28/01/2022)	1.5 – 2.9

ID	Location (Section)	Easting	Northing	Groundwater Level (mBGL)	Groundwater Elevation (mAOD)
	Pipeline (Section 4)				

18.6.36. **Table 18.7** shows that shallow groundwater levels have been recorded between Sections 1, 2, 3 and 4 fluctuating between slight artesian conditions and ~3.7 mBGL. Groundwater levels are noted to be shallow at the proposed location of Ince AGI (0.4 – 1.1 mbgl) and then deepen along the Newbuild Infrastructure Boundary to the east of Thornton Le Moors (3.0 – 3.7 mbgl). West of Thornton Green Lane within the Newbuild Infrastructure Boundary the groundwater levels rise and are shallow (0.5 mbgl) around the River Gowy with TPBH114 recording slight artesian conditions within the borehole headworks (0.1 magl). West of the River Gowy groundwater levels deepen again through Sections 3 and 4.

18.6.37. The response zone of groundwater monitoring borehole BH44 is within the tidal flat sand deposits. The recorded groundwater elevations ranged from 1.5 to 2.9 mAOD from November 2021 to March 2022. The responses zone of monitoring boreholes BH2 and BH5 are within the SSG aquifer, with recorded groundwater elevations fluctuating between 6 and 7.3 mAOD from November 2021 to March 2022. Data from the Environment Agency observation borehole at Chester Zoo (located ~600 m away from the Newbuild Infrastructure Boundary) has recorded groundwater levels between 10 to 13 mAOD from 1998 to 2021. Furthermore, the BGS Hydrogeological Map of Clwyd and the Cheshire Basin (**Ref. 18.64**) has indicated that groundwater elevations in the SSG are approximately 5-10 mAOD in Section 1 and 2; abstractions within the aquifer may have lowered the groundwater elevations in certain areas and may influence groundwater flows.

18.6.38. Data from the Environment Agency observation boreholes at Chester Zoo and Frodsham Marsh (approximately 2.6 km east of the Ince AGI) have indicated that groundwater levels and flows are influenced by tidal changes to a range of approximately 0.4 m between the high and low tides. The Environment Agency groundwater contour map has indicated that groundwater elevations in Section 1 and Section 2 are between 3 to 10 mAOD, comparable with the BGS Hydrogeological Map of Clwyd and the Cheshire Basin.

Section 4, Section 5 and Section 6

18.6.39. The GI results have recorded groundwater levels along the DCO Proposed Development from the River Dee, then westwards to the Flint AGI. The results include diver data from groundwater monitoring locations (groundwater levels/elevations with a max-min range in **Table 18.8** and manual spot measurements of water levels recorded after 20 minutes of a water strike.

Where the GI record is limited or there are large distances between the groundwater monitoring locations along the DCO Proposed Development, BGS historical borehole records were used to supplement groundwater level data. The groundwater level observations are shown in **Table 18.8**.

Table 18.8 - Groundwater levels from Section 4 to Section 6

ID	Location (Section)	Easting	Northing	Groundwater Level (mBGL)	Groundwater Elevation (mAOD)
BH54	At Chester Road East, south of Sandycroft County Primary School (Section 4)	332659	367337	1.1	5.9
BH55	At Chester Road East, north of Sandycroft County Primary School (Section 4)	332481	367486	0.16 – 1.33 (24/11/2021 – 04/02/2022)	3.87 – 3.95
BH109	To the west of Greenacres Animal Park, 30 m south of the indicative alignment of the Newbuild Carbon Dioxide Pipeline (Section 5)	331489	367235	1.5 – 2.3 (20/12/2021 – 01/12/2021)	21.7 – 20.9
BH64	South of Church Lane (Section 5)	330037	366985	6.16 - 6.19 (07/01/2022 – 20/01/2022)	76.52 – 76.49
BH65	Aston Hill Road (Section 5)	329901	367058	8.0	72
BGS SJ26NE21	South of Holywell Road, 100 m south of the indicative alignment of	329140	367030	2.3	76.38

ID	Location (Section)	Easting	Northing	Groundwater Level (mBGL)	Groundwater Elevation (mAOD)
	the Newbuild Carbon Dioxide Pipeline (Section 5)				
BGS SJ26NE27	South of Northop Hall, 70 m south of the indicative alignment of the Newbuild Carbon Dioxide Pipeline (Section 5)	326310	367640	6	83
BGS SJ26NE1426	South of Connah's Quay Road, 300 m west of the indicative alignment of the Newbuild Carbon Dioxide Pipeline (Section 6)	326310	367640	11	78

18.6.40. **Table 18.8** illustrates that groundwater levels are shallow around the River Dee (BH54 and BH55) fluctuating between 0.1 and 1.3 mbgl, however westwards past Ashton Hill the groundwater level deepens to 6 to 11 mbgl. GI groundwater level monitoring locations are sparsely spaced westwards from BH65, however BGS records generally indicate that there is a lack of groundwater within the glacial till. Water strikes are also shown in **Table 18.8**. Groundwater levels west of Aston Hill are deeper than those recorded at the River Dee estuary and to the east of the DCO Proposed Development, (6 to 11 mbgl).

Section 7

18.6.41. At the time of writing GI data in Section 7 is limited to 3 trial pits at each BVS location, therefore BGS borehole records have been used to identify groundwater levels. A review of BGS borehole logs which are screened through the Clwyd Limestone Group has indicated that groundwater levels vary. Borehole SJ17SE124, 0.5 km to the south-east of the Babell BVS has recorded a groundwater level at 62 mbgl (135 mAOD). While boreholes along the A55 in

the Clwyd Limestone Group at SJ17NE209 have encountered groundwater levels at 5 mbgl (190 mAOD), whilst at SJ17NE7 no groundwater was encountered. The variation in groundwater levels highlights the control fractures have on groundwater levels in the limestone.

18.6.42. A review of BGS borehole logs in the Craven Group and Millstone Grit Group has indicated that groundwater levels may be relatively shallow at the Cornist Lane and Pentre Halkyn BVS. 1.1 km to the west of Cornist Lane BVS, borehole log SJ27SW539 has indicated a spring was identified at 172 mAOD and at borehole SJ27SW2, 1 km to the west of Flint AGI, a groundwater level of 37 mAOD (2 mbgl) has been recorded. Boreholes along the A55 at Pentre Halkyn have indicated that shallow groundwater in the superficial deposits may be present between 1.5 to 3 mbgl, however several boreholes were recorded as being dry.

Groundwater quality

18.6.43. The quality of the groundwater bodies which underlie the DCO Proposed Development are monitored by the Environment Agency (**Ref. 18.37**) and NRW (**Ref. 18.66**) in accordance with the WFD objectives.

Section 1 and Section 2

18.6.44. Sections 1 and 2 up to the Shropshire Union Canal are part of the Wirral and Cheshire West Permo-Triassic Sandstone Aquifer (**Ref. 18.37)** which has a current 2019 Cycle 2 assessment of Poor chemical status (Good quantitative status) and Poor overall status. Sections 1 and 2 are classified as having a Medium to Low groundwater vulnerability. Low vulnerability is described as low priority groundwater resources that have a high degree of natural protection, this reduces their overall risk of pollution from surface activities (**Ref. 18.47**). Medium vulnerability is described as medium priority groundwater resources that have some natural protection resulting in a Moderate overall groundwater risk. Activities in these areas will as a minimum follow good practice to ensure they do not cause groundwater pollution (**Ref. 18.47**). Both Sections 1 and 2 are found within a Nitrate Vulnerable Zone (NVZ), NVZ are areas designated as being at risk from agricultural nitrate pollution (**Ref. 18.47**)

18.6.45. Due to the proximity to the sea, historic over-abstraction may have caused saline intrusion (**Ref.18.61**). Therefore, groundwater in Sections 1 and 2 may have a higher Electrical Conductivity (EC), Total Dissolved Solids (TDS) and chemical constituents such as Cl, Na, Mg, and SO_4. To the north of Stanlow AGI the Stanlow Manufacturing Complex is a high density of potentially polluting industries which could impact groundwater quality in this area.

18.6.46. The Environment Agency sampling point at Thornton-le-Moors (Shell Oil Stanlow Bh .No. 25 Sj47/13 S) is located approximately 150 m west of the indicative alignment of the Newbuild Carbon Dioxide Pipeline **(Ref. 18.65)** . On

17 February 2020 sampling was undertaken which recorded chloride (130 mg/l), dissolved sodium (77 mg/l), nitrate (0.22 mg/l) and nitrite (<0.004 mg/l) all below the exceedance values of the Water Supply (Water Quality) Regulations 2016. However dissolved metals were high, with manganese (300 ug/l) and iron (580 ug/l) above the water supply regulations. On the 18 February 2020 the Chester Zoo observation borehole, 0.7 km south of the indicative alignment of the Newbuild Carbon Dioxide Pipeline, has indicated that chloride (45 mg/l) and sodium (23 mg/l) were lower than the Thornton-le-Moors borehole, while nitrate (6.5 mg/l) and nitrite (0.004 mg/l) were slightly higher but still below the water supply regulations. Dissolved manganese (<10) and iron (<30) were also substantially lower than at Thornton-le-Moors and the water supply regulations.

Section 2, Section 3 and Section 4

18.6.47. Section 2 west of the Shropshire Union Canal and Section 3 are part of the Dee Permo-Triassic Sandstone Water Body (**Ref. 18.34**) which has a current 2019 Cycle 2 assessment of Poor chemical status (Good quantitative status) and Poor overall status. Section 4 is part of the Dee Carboniferous Coal Measures Water Body (**Ref. 18.66**), which has a current 2019 Cycle 2 assessment of Poor chemical status (Good quantitative status) and Poor overall status.

18.6.48. Sections 3 and 4 are classified as having low to high groundwater vulnerability. To the east of Saughall the groundwater vulnerability is Low. While to the south and west of Saughall the groundwater vulnerability becomes Medium to Medium-high. Medium-high vulnerability has been described as high priority groundwater resources that have limited natural protection. This results in a Medium-high overall pollution risk to groundwater from surface activities. Activities in these areas may require additional measures over and above good practice to ensure they do not cause groundwater pollution (**Ref 18:45**). For example, a phased approach to construction which limits the exposure of the aquifer to pollutants, additional measures to limit the potential of spillage from vehicles, control of rainfall runoff reducing turbidity increases, etc. These measures, if necessary, will be established in a detailed CEMP.

18.6.49. From Sealand westward across the River Dee to Deeside, the groundwater vulnerability is High due to the more permeable tidal flat deposits (compared to the glacial till). High groundwater vulnerability has been described as high priority groundwater resources that have very limited natural protection. This results in a high overall pollution risk to groundwater from surface activities. Operations or activities in these areas are likely to require additional measures over and above good practice pollution prevention requirements to ensure that groundwater isn't impacted (**Ref. 18.61**). Both Sections 3 and 4 are found within a Nitrate Vulnerable Zone (NVZ).

18.6.50. Sections 3 and 4 may have a risk of saline intrusion due to the proximity of the sea (6 km). The Environment Agency sampling point at Chester Textiles, Blacon, is located 3.6 km east of the Newbuild Infrastructure Boundary (**Ref.**

18.67). On 22 February 2019 sampling was undertaken which recorded chloride (60 mg/l), dissolved sodium (46 mg/l), nitrate (0.22 mg/l) and nitrite (<0.004 mg/l) all to be below the exceedance values of the Water Supply (Water Quality) Regulations 2016.

Section 5 and Section 6

18.6.51. Sections 5 and 6 are part of the Dee Carboniferous Coal Measures Water Body (**Ref. 18.66**) described above. Groundwater vulnerability at Deeside is High over the tidal flat deposits, however moving west towards Northop Hall the groundwater vulnerability is Low due to the overlying, low permeability glacial till deposits (**Ref. 18.61**). A small area of high groundwater vulnerability is found at Ewloe Green associated with the more permeable glaciofluvial deposits. West from Ewloe Green the groundwater vulnerability is low until the Flint AGI due to the glacial till deposits (**Ref. 18.61**). There are no NVZ within Sections 5 and 6 (**Ref. 18.61**). Sections 5 and 6 may have a risk of saline intrusion due to proximity to the sea (2 km).

Section 7

18.6.52. Cornist Lane BVS is found within the Dee Carboniferous Coal Measures Water Body described above (**Ref. 18.66**). The Cornist Lane BVS is found in a Low groundwater vulnerability area (**Ref. 18.61**). The Pentre Halkyn and Babell BVS are found within the Clwyd Carboniferous Limestone groundwater body which has a Good chemical status (Good quantitative status) and Good overall status (**Ref. 18.61**). Groundwater vulnerability at these BVSs is high due to the presence of the limestone aquifers.

Groundwater abstractions

18.6.53. At no point is the DCO Proposed Development found within a Source Protection Zone (SPZ). The closest SPZs are ~2 km south east of the Newbuild Infrastructure Boundary at Elton, 2km south east at Caughall and 0.7 km south east at the River Dee.

18.6.54. Both NRW and the Environment Agency were contacted on 17 May 2021 and 22 September 2021 respectively for information on licenced groundwater abstractions located within 3 km of the Newbuild Infrastructure Boundary. NRW responded on 22 September 2021 informing that all licenced abstraction information for Wales is stored on the Lle Geo-portal for Wales (**Ref. 18.66**). The Environment Agency responded on 18 January 2022 with all licenced abstractions in England within 3km of the Newbuild Infrastructure Boundary.

18.6.55. The Environmental Health Departments of FCC and CWCC were contacted on 7 March 2022 and 26 April 2022 respectively to request any information they held with regards to private water supplies. A response was received from Flintshire County Council on 23 May 2022 and Cheshire West and Chester Council on 19 May 2022. Both provided records on PWS within 3 km of the

Newbuild Infrastructure Boundary. Several abstractions did not have coordinates and their exact locations are unknown.

18.6.56. Abstractions and discharges beyond 1 km of the Newbuild Infrastructure Boundary were scoped out as it was determined by professional judgement that the DCO Proposed Development will have a negligible effect on resources beyond this distance. Furthermore, no SPZ designations related to abstractions are within 1 km of the Newbuild Infrastructure Boundary. The BGS GeoIndex (**Ref. 18.61**) indicates numerous records of boreholes drilled for water supply purposes are situated within 1 km of the Newbuild Infrastructure Boundary, these records are historic and it is unknown if they represent active abstractions. Boreholes indicated to be intended for water supply on historic borehole logs BGS GeoIndex (**Ref. 18.61**) that have been identified close to the Newbuild Infrastructure Boundary have been treated as if they were active abstractions. Although every effort within reasonable expectations has been made to identify and obtain information on private, unlicenced groundwater abstractions, it remains a possibility that some local properties rely on a private water supply that have not been recorded within the data received, or their locations are not known as indicated above. Details of the known groundwater abstractions are summarised in **Table 18.9**.

Table 18.9 - Licenced groundwater abstractions and known private water abstractions within 1 km of the Newbuild Infrastructure Boundary

Name	Section	Purpose	Distance from Newbuild Infrastructure Boundary	E	N
Parkgate Road	1	Industrial, Commercial and Public Services	0.25 km north	344954	375514
Bickley Hall Farm	2	Environmental	0.2 km north	343465	373334
First Floor North	2	Industrial, Commercial and Public Services	0.2 km north east	341700	371600
Croughton Road Caughall	2	Private Water Supply	0.09 km north east	341440	371280
Bridge Farm	2	Private Water Supply	1 km north	341868	372485
Canal Turn	2	Private Water Supply	1 km north	341906	372433
Pennywell Farm	2	Private Water Supply	0.9 km north	341886	372392
Top Farm	2	Private Water Supply	0.85 km north	341830	372351

Name	Section	Purpose	Distance from Newbuild Infrastructure Boundary	E	N
Croughton House	2	Private Water Supply	0.65 km north	341492	372185
Chorlton Lodge Farm	2	Private Water Supply	0.65 km north	340737	371973
Warren Farm	3	Agriculture	0.3 km north west	337900	370690
The Vicarage	3	Private Water Supply (heat pump)	1 km north west	335954	370044
Grange Farm	3	Private Water Supply	0.75 km south	338799	369352
WT Banks & Co	4	Agriculture	1 km north west	333955	367720
Saltney Ferry small single dwelling	4	Private Water Supply	0.6 km east	336008	366156
Northop Hall small two or more dwellings	5	Private Water Supply	0.3 km north	328080	367624
Essity UK Limited	6	Industrial, Commercial, Public Services	1 km east	326334	371176
Essity UK Limited	6	Industrial, Commercial, Public Services	1 km north	325525	372065
Flint BH small single dwelling	6	Private Water Supply	0.3 km east	326012	370419

Groundwater Dependent Terrestrial Ecosystems

18.6.57. A review of the Environment Agency's data on GWDTEs has identified that within the Newbuild Infrastructure Boundary only the River Dee estuary has been classified as a potential GWDTE, as part of the Dee Estuary / Aber Afon Dyfrdwy SSSI that runs the length of the Dee Estuary from Connah's Quay at the mouth of the River Dee, out to Prestatyn (21 km). The Newbuild Infrastructure Boundary crosses this designation to the east of Sandycroft at the River Dee.

18.6.58. A National Vegetation Classification (NVC) survey was undertaken across the specific area of the Newbuild Infrastructure Boundary (**Chapter 9 – Biodiversity (Volume II)**). From the Ince AGI south until the Chester Services, the site has been identified through the GI as an area of shallow groundwater (groundwater levels between 0.4-1.1 mbgl). Within this area the NVC survey identified a potential GWDTE community. The community identified is:

- MG9 - Holcus lanatus - Deschampsia cespitosa grassland

18.6.59. Approximately 500 m either side of the River Gowy groundwater levels are shallow (0.5 mbgl). Within this area the NVC survey identified potential GWDTE communities. The communities identified are:

- MG9 - Holcus lanatus - Deschampsia cespitosa grassland;
- MG10 - Holcus lanatus - Juncus effusus rush pasture;
- S5 - Glyceria maxima swamp;
- S12 - Typha latifolia swamp; and
- S28 - Phalaris arundinacea tall-herb fen.

18.6.60. Communities MG10 and MG9 are described as having a moderate dependency on groundwater and MG13, S5, S12 and S28 are described having a low dependency on groundwater (**Ref. 18.68**). NVC mapping for the Newbuild Infrastructure Boundary is shown on **Figure 18.3 Radii of Influence (Volume IV).**

18.6.61. Peat has been identified by the GI within the Newbuild Infrastructure Boundary to the south of the Ince AGI and across the River Gowy. South of the Ince AGI, pseudo-fibrous peat is present at 1-2 mbgl, overlain by tidal flat deposits. Peat has been recorded to a maximum depth of 9.93 mbgl interbedded with clay to 200 m south of the Ince AGI. At the River Gowy, peat has been observed just below the topsoil and/or superficial clay deposits between 0.4 and 1 mbgl. Peat has been recorded at a maximum depth of 5.76 mbgl, interbedded with clay. BGS borehole SJ47SW180 has indicated that dark brown organic sand with layers of clayey amorphous peat is present between 0-0.5 mbgl, followed by black/brown saturated amorphous plastic peat with layers of fibrous peat and concentration of stems and wood between 0.5 and 5.5 mbgl.

Flood Risk

Fluvial/Tidal Flood Risk

18.6.62. In England, based on the Flood Map for Planning (**Ref. 18.33**), the Newbuild Infrastructure Boundary crosses Flood Zone 3 at the following locations (please refer to **Figure 3.2 - DCO Proposed Development (Volume IV)**):

- Ince AGI; fluvial floodplain associated with the East and West Central Drain and Hapsford Brook (defended). Also, tidal floodplain associated with the River Mersey (defended);

- South of Stanlow AGI; fluvial floodplain associated with the Gale Brook (undefended);
- South of the M56; floodplain associated with the River Gowy, Stanney Mill Brook, Stanney Main Drain, and the associated ditch network (undefended);
- North of Moston; floodplain associated with the Backford Brook and Finchetts Gutter (undefended) ; and
- South of Saughall; tidal floodplain of the Seahill Drain and Dee Estuary (defended).

18.6.63. Flood Zone 3 is an area where the annual probability of fluvial or tidal flooding is higher than 1% and 0.5%, respectively, in the absence of flood defences.

18.6.64. A very limited extent of Flood Zone 2 is also present in some of the above areas; Flood Zone 2 is an area having between 0.1% and 1% chance of flooding any given year from rivers, or between 0.1% and 0.5% chance of flooding any given year from the sea, in the absence of flood defences.

18.6.65. In Wales, based on the Flood Map for Planning (**Ref. 18.44**), the Newbuild Infrastructure Boundary crosses the defended tidal Flood Zone C1 at the Dee Estuary. This area is extensive and will have a probability of tidal flooding in excess of 0.5% every year in the absence of flood defences, however it is protected by tidal flood defences. These defences run along the edge of the River Dee, Sealand Main Drain, Seahill Drain, Broughton Brook and Sandycroft drain.

18.6.66. This area which is protected by tidal defences to the west of the River Dee is also partially within the fluvial Flood Zone B and, for a much minor extent, Flood Zone C, where the probability of flooding every year is between 1% and 0.1% and higher than 1%, respectively. This fluvial flood risk is associated with the Broughton Brook.

18.6.67. The Newbuild Infrastructure Boundary also crosses a localised undefended fluvial Flood Zone C associated to the Alltami Brook and Wepre Brook.

18.6.68. The location of the proposed Ince AGI is defended against Tidal Flooding from the Manchester Ship Canal, whilst a pumping station (owned and maintained by the EA) prevents fluvial flooding of the marshes. It is possible that in the future the EA may stop the operation and maintenance of the pumping station. In this scenario, engagement with Peel has confirmed that local businesses and Peel will acquire the pumps. Based on the above the risk of fluvial and tidal flooding remain low. For more information, please refer to **Flood Risk Assessment (Appendix 18.4 (Volume III)).**

18.6.69. The Location of the proposed Stanlow AGI is just north of the floodplain extent, almost entirely located within Flood Zone 1; recent modelling undertaken on behalf of the EA by Jacobs, the Stanlow and Tranmere Flood Risk Management

study (**Ref. 18.32)** shows that the area is at low risk of fluvial and tidal flooding and will not flood in a 0.1% AEP, 1 in 1000 year return period flood event.

18.6.70. The area of the proposed Flint AGI is within Flood Zone A which is an area at little or no risk of fluvial/tidal flooding.

18.6.71. The six proposed BVSs along the Carbon Dioxide Pipeline, are all located within areas of land with a 0.1% (or less) chance of flooding each year from rivers or the sea. Their locations are within Flood Zone 1 or A which is considered to be at low risk of fluvial or tidal/coastal flooding.

18.6.72. The recorded flood (**Ref. 18.35**) outline shows that the following areas have previously flooded from fluvial or coastal sources:

- Rural land west of Thornton le Moors (April 1971);
- Knolls Bridge, Chester (January 1964);
- Part of Deeside Industrial Estate (Date not published);
- Land south east of Garden City (Date not published);
- Land between Sandycroft and A5104 Chester Road (Date not published); and
- Land at Ewloe Green (Date not published)

Surface Water Flood Risk

18.6.73. There are areas of surface water flooding scattered throughout the Newbuild Infrastructure Boundary, mostly associated with ordinary watercourses or overland flow routes. Notable locations include:

- Land east of Pool Lane, Stanlow Manufacturing Complex.
- Land adjacent to Gale Brook.
- Land adjacent to Thornton Main Drain.
- Land adjacent to the River Gowy and its tributaries.
- Land adjacent to the Shropshire Union Canal, Wervin.
- Chorlton Lane.
- Collinge Wood.
- South of Station Road, Lea by Backford.
- Land adjacent to Grove Road, Lea by Backford.
- Land east of Parkgate Road, Mollington.
- Land south west of Chester Road, Sandycroft.
- Land south of Flint AGI

18.6.74. Based on the available information, the proposed Rock Bank BVS access road is slightly encroaching in an area at high risk of surface water flooding. The proposed Flint AGI's platform embankment slightly intersects a surface water flow path. The AGIs at Ince, Stanlow and Flint and the remaining proposed

BVSs are at low risk of surface water (areas of land with 0.1% (or less) chance of flooding each year from surface water.

Groundwater Flood Risk

18.6.75. Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Shallow groundwater levels can be expected near surface water courses which are typical receptors for groundwater flow.

Section 1 and Section 2

18.6.76. The Groundsure Report (see **Annex B of Appendix 11.1 - Phase I Land and Soil (Contaminated Land) Baseline Report (Volume III)**) indicates that the area to the east of Elton at the Ince AGI, south towards the M56, has been classified as having a high groundwater flood risk. The high groundwater flood risk in this area is due to high groundwater levels, as can be observed by the groundwater levels recorded by the GI (**Table 18.7** and **Figure 18.2 – Superficial and Bedrock Geology (Volume IV)**.

18.6.77. The risk assessment is based on a 1 in 100 year return period (**Ref. 18.58**). To the south of Elton Green, the groundwater flood risk is reduced to moderate, until the River Gowy, where there is a high risk of groundwater flooding. Alongside the River Gowy, peat is present and the ground conditions are assumed to be marshy with a shallow groundwater level. The area west of the River Gowy, to Backford, has a low groundwater flood risk, due to low permeability glacial till deposits. This is with the exception of the Shropshire Union Canal, with its banks being classified as high-medium groundwater flood risk.

Section 3, Section 4, Section 5 and Section 6

18.6.78. The Groundsure Report (see **Annex B of Appendix 11.1 – Phase 1 Land and Soil (Contaminated Land) Baseline (Volume III**)) indicates that the area to the west of the Shropshire Union Canal has a low groundwater flood risk, up until Sealand, where the flood risk becomes moderate to high (across the River Dee). This is due to the transition from the glacial till to the tidal flat deposits which have a higher permeability by comparison and are less likely to act as a confining layer. West of the of Chester Road in Deeside, the glacial till is present and a low groundwater flood risk classification exists across the indicative alignment of the Newbuild Carbon Dioxide Pipeline up to the Flint AGI. There are two areas of moderate groundwater flood risk associated with the glaciofluvial deposits to the east of Ewloe and east of the Flint AGI.

Section 7

18.6.79. The Groundsure Report (see **Annex B of Appendix 11.1 – Phase 1 Land and Soils (Contaminated Land) Baseline) (Volume III)**) indicates that all of the BVSs are within low groundwater flood risk areas, primarily due to them being underlain by the glacial till deposits, and also deeper groundwater levels.

Water Framework Directive

18.6.80. All WFD water bodies either crossed by the Newbuild Infrastructure Boundary or immediately downstream of the DCO Proposed Development are presented in **Table 18.10** and **Table 18.11**, along with their current WFD status. The water bodies presented in both tables are ordered from east to west along the Newbuild Infrastructure Boundary. The location of these WFD waterbodies is shown in **Appendix 18.3 – WFDa (Volume III).**

Table 18.10 - WFD Water Bodies Crossed by, or Immediately Downstream, of the Newbuild Infrastructure Boundary

WFD water body name	WFD water body ID	Water body type	Connection with the Newbuild Infrastructure Boundary	Overall Status	Ecological Status	Chemical Status	Target Ecological Status / Potential
Peckmill Brook, Hoolpool Gutter and Ince Marshes	GB112068060330	River	The Ince AGI is located within this water body. East Central Drain is within this water body and is proposed to receive runoff from Ince AGI drainage system. Three main rivers and seven ditches will be crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Poor by 2015 (disproportionate burdens; technically infeasible)
Gowy (Milton Brook to Mersey)	GB112068060250	River (Heavily Modified Water Body (HMWB))	Three main rivers and three ditches within this water body will be crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Moderate by 2027 (disproportionate burdens; technically infeasible)
Stanney Mill Brook	GB112068060260	River (HMWB)	One main river and one ditch within this water body are crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Good by 2027

WFD water body name	WFD water body ID	Water body type	Connection with the Newbuild Infrastructure Boundary	Overall Status	Ecological Status	Chemical Status	Target Ecological Status / Potential
Mersey	GB531206908100	Transitional (HMWB)	This water body is not crossed by the Newbuild Carbon Dioxide Pipeline. It is the downstream water body of Gowy (Milton Brook to Mersey) which is crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Good by 2027
Shropshire Union Canal, Market Drayton to Ellesmere Port	GB71210133	Artificial	Crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Good by 2021
Manchester Ship Canal	GB71210004	Artificial	This water body is not crossed by the Newbuild Carbon Dioxide Pipeline. It is downstream of Shropshire Union Canal which is crossed by the Newbuild Carbon Dioxide Pipeline. It also receives pumped water from Ince Marshes which are crossed by the Ince Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Good by 2027

WFD water body name	WFD water body ID	Water body type	Connection with the Newbuild Infrastructure Boundary	Overall Status	Ecological Status	Chemical Status	Target Ecological Status / Potential
Garden City Drain	GB111067056960	River (HMWB)	A main river and an ordinary watercourse within this waterbody are crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Fail	Good by 2027
Finchetts Gutter	GB111067056930	River (HMWB)	Two main rivers and six ordinary watercourses within this waterbody are crossed by the Newbuild Carbon Dioxide Pipeline.	Poor	Poor	Fail	Good by 2027
Dee (North Wales)	GB531106708200	Transitional	The Dee is crossed by the Newbuild Carbon Dioxide Pipeline. There are four non-reportable ordinary watercourses within this water body which are either crossed by the Newbuild Carbon Dioxide Pipeline or receive runoff from Flint AGI.	Moderate	Moderate	Fail	Good by 2021
Sandycroft Drain	GB111067052160	River	Three main rivers and two ordinary watercourses within this water body are crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Good	Good by 2021

WFD water body name	WFD water body ID	Water body type	Connection with the Newbuild Infrastructure Boundary	Overall Status	Ecological Status	Chemical Status	Target Ecological Status / Potential
Wepre Brook	GB111067056880	River	Three ordinary watercourses within this water body are crossed by the Newbuild Carbon Dioxide Pipeline.	Moderate	Moderate	Good	Good by 2027
Swinchiard Brook	GB111067056940	River	The Cornist Lane BVS is located within this water body and is proposed to discharge runoff to the Nant-y-Fflint which is within this water body.	Good	Good	Good	Good by 2015
Pant-Gwyn (Wheeler)	GB110066059940	River	The Pentre Halkyn BVS is located within this water body.	Good	Good	Good	Good by 2015
Wheeler – lower	GB110066059930	River	The Babell BVS is located within this water body.	Good	Good	Good	Good by 2021

Table 18.11 - WFD Groundwater Bodies Crossed by, or Immediately Downstream, of the Newbuild Infrastructure Boundary

WFD water body name	WFD water body ID	Water body type	Connection with DCO Proposed Development	Overall Status	Quantitative Status	Chemical Status
Wirral and West Cheshire Permo-Triassic Sandstone Aquifers	GB41101G202600	Groundwater	Crossed by the Newbuild Carbon Dioxide Pipeline.	Poor	Good	Poor
Dee Permo-Triassic Sandstone	GB41101G202400	Groundwater	Crossed by the Newbuild Carbon Dioxide Pipeline.	Poor	Good	Poor
Dee Carboniferous Coal Measures	GB41102G204800	Groundwater	Crossed by the Newbuild Carbon Dioxide Pipeline. Cornist Lane BVS is located within this water body.	Poor	Good	Poor
Clwyd Carboniferous Limestone	GB41001G200300	Groundwater	Babell and Pentre Halkyn BVSs are located within this water body.	Good	Good	Good

FUTURE BASELINE

Surface water

18.6.81. It is not expected that there will be significant changes between current and future baseline for surface water features. The WFD target status and anticipated date of achievement for all WFD water bodies within the Study Area are included in **Table 18.10**. Once the water bodies have achieved Good ecological status / potential, the WFD legislation requires this status to be maintained.

Groundwater

18.6.82. The future baseline of the DCO Proposed Development is expected to include a rise in groundwater levels in coastal areas due to rising sea levels. This may extend/accentuate saline intrusion.

Flood risk

18.6.83. Climate change is expected to influence hydrological processes in the Study Area (and elsewhere): climate change will impact on rainfall intensity, tidal and coastal levels and peak river flows, which in turn is going to influence flood risk. Peak rainfall intensity is predicted to increase between 20% to 40% (Central and Upper End estimates, respectively) by 2080s (2070 to 2115) (**Ref. 18.69** and **Ref. 18.70**). Peak river flows are predicted to increase as per **Table 18.12**.

Table 18.12 - Peak river flow allowances (using UK Climate projections) for catchments crossed by the Newbuild Infrastructure Boundary (2080s) (Ref. 18.69 and Ref. 18.70)

Scenario	Weaver Gowy	Dee (England)	Dee (Wales)
Upper End	86%	50%	30%
Higher central	55%	30%	15%
Central	42%	22%	5%

18.6.84. Climate change is also expected to cause sea level rise along the Welsh and English coastline. The predicted rise for the 2060 epoch is presented in **Table 18.13** (**Ref. 18.69** and **Ref. 18.71**).

Table 18.13 - Sea level allowances in England and Wales for up to the corresponding 2060 epoch (2036 to 2065)

	England (North West)	Wales
Annual change (mm/yr)	7.3	11.5
Total increase	219mm	345mm

18.7. SENSITIVE RECEPTORS

18.7.1. The following sensitive receptors have been assessed and are displayed in **Table 18.14** below.

Table 18.14 - Sensitivity of Receptors

Sensitivity	Receptor	Justification
Very High	Dee Estuary Special Protection Area	These receptors are protected areas.
	Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and Cockle Regulating Order)	
	River Dee	The River Dee, Manchester Ship Canal and Shropshire Union Canal are monitored under WFD and have a Q95 > 1m^3/s.
	Shropshire Union Canal	
	Manchester Ship Canal	
	Residents and users of the Surrounding Land	Residential uses are generally classified as 'more vulnerable' in the Flood Risk and Coastal Change Planning Policy Guidance although, for example, basement accommodation is considered as 'Highly Vulnerable' (Table 2). Residents of the surrounding areas might have limited or no awareness of flood risk and sensitivity of residents is therefore high. As a precautionary approach, these receptors and users (e.g., workers, customers) of surrounding activities are assumed as having a 'very high' sensitivity.
High	River Gowy, Stanney Mill Brook	These main rivers are monitored under WFD and have a Q95 < 1m^3/s.
	Railway Ditch 1, Railway Ditch 2, Mancot Brook	These are ordinary watercourses with low flows (Q95<0.001m^3/s). However, these watercourses are habitat for European Eel which are a protected species under the Natural Environment and Rural Communities (NERC) Act (**Ref. 18.72**).
	Broughton Brook	This main river has a Q95> 0.001m^3/s and is monitored under WFD. This watercourse is a habitat for European Eel and Brown/Sea Trout which is a protected species under the NERC Act (**Ref. 18.72**).
	Wepre Brook	This is an ordinary watercourse with Q95> 0.001m^3/s and is monitored under WFD. This watercourse is a habitat for European Eel which is a protected species under the NERC Act (**Ref. 18.72**).
	Northop Brook, New Inn Brook	These are ordinary watercourses with Q95> 0.001m^3/s. This watercourse is a habitat for European Eel and Brown/Sea Trout which are protected species under the NERC Act (**Ref. 18.72**).

Sensitivity	Receptor	Justification
	Seahill Tributary 2, Sandycroft Drain	These are ordinary watercourses with a Q95>0.001m^3/s. These watercourses are habitat for European Eel which is a protected species under the NERC Act (**Ref. 18.72**).
	Seahill Drain, Chester Road Brook Tributary 2, Chester Road Drain North	These main rivers have a Q95>0.001m^3/s and a not monitored under WFD. This watercourse is habitat for European Eel which is a protected species under the NERC Act (**Ref. 18.72**).
	Willow Park Brook	This is an ordinary watercourse with Q95 > 0.001m^3/s. This watercourse is habitat for Brown/Sea Trout which is a protected species under the NERC Act (**Ref. 18.72**).
	Alltami Brook	This is an ordinary watercourse with Q95 flows > 0.001m^3/s. This watercourse is deemed to have a high sensitivity based upon the river condition assessment undertaken at the Site.
	Principal aquifer (Sherwood Sandstone Formation and Clwyd Limestone Group)	Principal aquifer providing locally important resource or supporting a river ecosystem as outlined in DMRB LA 104 (**Ref. 18.60**)
	Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	GWDTE potentially connected to groundwater which will be sensitive to a change in the groundwater regime.
Medium	Finchetts Gutter Tributary, Gowy Tributary 2, Rake Lane Brook, Friars Park Ditch, Sandycroft Drain, Little Lead Brook and Nant-y-Fflint	These are ordinary watercourses with a Q95>0.001m^3/s.
	East Central Drain, West Central Drain, Hapsford Brook, Gale Brook, Thornton Uplands, Stanney Main Drain, Backford Brook, Hawarden Brook and Sealand Main Drain	These are main rivers with a Q95>0.001m^3/s. They are not monitored under WFD.
	Secondary A aquifers (superficial deposits, Pennine Coal Measures Group, Millstone Grit Group, Etruria Formation)	Aquifer providing agricultural or industrial uses, not locally important as outlined in DMRB LA 104 (**Ref. 18.72**).

Sensitivity	Receptor	Justification
	Groundwater abstractions	Abstractions are for agricultural, industrial and domestic use. No public supply or locally important abstractions were identified within the Study Area. No SPZ protected abstractions are within the Newbuild Infrastructure Boundary.
	Construction Workers	Flooding may impact upon construction workers. Their sensitivity is generally lowered as a result of a level of competence attained through appropriate health and safety training commonly exercised by competent contractors and their presence on site only during working hours.
Low	Elton Lane South Ditch, Elton Marsh 1, Elton Brook Tributary, Wervin Hall Ditch Tributary, Elton Lane Ditch 1, Elton Lane Ditch 4, Elton Marsh 2, Elton Marsh 13, Hall Green Lane Brook, Thornton Ditch 1, Thornton Ditch 2, Collinge Wood Brook, Grove Road Ditch, Gypsy Lane Brook, Mancot Brook Tributary, Oakfield Ditch 3, Northop Brook Tributary 2, Northop Brook Tributary 1, Canal Ditch.	These are ordinary watercourses with low flows (Q95<0.001m^3/s). These watercourses are crossed by the Newbuild Carbon Dioxide Pipeline.
	Overwood Ditch, Aston Hall Brook Tributary, Elton Lane Ditch 2, Elton Lane Ditch 6, Glass Factory Ditch, Elton Marshes West, Elton Marsh 3, Elton Marsh 12, Elton Marsh 11, Elton Marsh 10, Thornton Ditch 4, Thornton Ditch 5, Thornton Ditch 6, Thornton Ditch 3, Gowy Tributary 2, Oakfield Ditch 1	These are ordinary watercourses with low flows (Q95<0.001m^3/s). These watercourses are not crossed by the Newbuild Carbon Dioxide Pipeline.
	Secondary B aquifers, Secondary undifferentiated aquifers and unproductive strata	Aquifers are not an important recourse with low productivity or are unproductive strata.

18.8. DESIGN DEVELOPMENT, IMPACT AVOIDANCE AND EMBEDDED MITIGATION

CONSTRUCTION STAGE

Groundwater

18.8.1. In areas of shallow groundwater, sheet-piles will be used as a hydraulic control measure to limit the ingress of water into excavations (**D-WR-036** of the **Register of Environmental Actions and Commitments (REAC), Document reference: D.6.5.1**).

18.8.2. At the Croughton Road Caughall abstraction, an existing overhead power line (which will not be moved) will act as a constraint on the final positioning of the pipeline within the Permanent Acquisition of Subsurface Area, preventing the expected radius of influence of any dewatering from reaching the abstraction and therefore preventing an impact (**D-WR-038** of the **REAC, Document reference: D.6.5.1**). This is considered an embedded mitigation.

18.8.3. At the GWDTE at the River Gowy, the GWDTE is situated to the south of the NVC vegetation area which the pipeline will not encroach into. As the expected radius of influence from the dewatering does not extend into this area of GWDTE, there is no impact to it anticipated (**D-WR-067** of the **REAC, Document reference: D.6.5.1**). This is also considered an embedded mitigation.

Flood Risk

18.8.4. All Centralised Compounds are located outside the fluvial and coastal floodplain which reduces risk to construction workers and minimises any negative impacts on flood risk (**D-WR-001** of the **REAC, Document reference: D.6.5.1**).

OPERATIONAL STAGE

Groundwater

18.8.5. Where needed, trench breakers (clay plugs) will be placed in the trench to avoid preferential flow pathways for groundwater flow (**D-WR-039** of the **REAC, Document reference: D.6.5.1**).

18.8.6. At each AGI and BVS an outline drainage strategy has been proposed. This contains indicative information regarding proposed measures to attenuate and discharge surface runoff (**Outline Surface Water Drainage Strategy Report, Document reference: D.6.5.13**) (**D-WR-009** of the **REAC, Document reference: D.6.5.1**). Pollution-prevention has been proposed within the design to follow the SuDS management train as set

out within the relevant Local Authority's SFRAs, Surface Water Management Plans and related documents. This includes infiltration trenches to act as filters, a vortex separator and vegetated detention ponds.

Flood Risk

18.8.7. An **FRA (Appendix 18.4 (Volume III))** and **FCA (Appendix 18.5 (Volume III))** have been produced in line with NPPF (**Ref. 18.17**) and TAN 15 (**Ref. 18.25**) to investigate flood risk and ensure that appropriate mitigation measures are embedded in the proposals for any AGIs and BVSs to mitigate flood risk through design while avoiding negative impacts elsewhere. Those include raising the platform at Ince AGI.

18.8.8. The **Outline Surface Water Drainage Strategy Report** (**Document reference: D.6.5.13)** contains indicative information ensuring that surface water runoff is controlled and discharged in line with policy and best practice.

18.9. ASSESSMENT OF LIKELY IMPACTS AND EFFECTS

18.9.1. This section summarises the assessment of predicted impacts and effects for the DCO Proposed Development during the Construction, Operational and Decommissioning stages. The detailed assessment is presented in **Appendix 18.2 – Assessment of Effects (Volume III).**

SIGNIFICANT EFFECTS

Construction Stage

18.9.2. This section summarises those effects identified as significant during the Construction Stage.

Impacts to water quality and hydromorphology by entrainment of sediments

- Shropshire Union Canal, River Dee;
- Watercourses which are crossed by open cut methods with a Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species, including: Stanney Mill Brook, Seahill Tributary 2, Seahill Drain, Sandycroft Drain, Chester Road Drain North, Mancot Brook, Chester Road Brook Tributary 2, Willow Park Brook, New Inn Brook, Alltami Brook, Wepre Brook;
- Watercourses which are crossed by open cut methods with Q95>0.001m^3/s not monitored under WFD, including: East Central Drain, West Central Drain, Hapsford Brook, Gale Brook, Thornton Uplands, Stanney Main Drain, Gowy Tributary 2, Rake Lane Brook, Backford Brook, Friars Park Ditch, Finchetts Gutter Tributary, Sealand Main Drain; and

- Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and Cockle Regulating Order).

Impacts to water quality by spillage of pollutants

- River Dee;
- Watercourses which are crossed by open cut methods with a Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species, including: Stanney Mill Brook, Seahill Tributary 2, Seahill Drain, Sandycroft Drain, Chester Road Drain North, Mancot Brook, Chester Road Brook Tributary 2, Willow Park Brook, New Inn Brook, Alltami Brook, Wepre Brook;
- Watercourses which are crossed by open cut methods with Q95>0.001m^3/s not monitored under WFD, including: East Central Drain, West Central Drain, Hapsford Brook, Gale Brook, Thornton Uplands, Stanney Main Drain, Gowy Tributary 2, Rake Lane Brook, Backford Brook, Friars Park Ditch, Finchetts Gutter Tributary, Sealand Main Drain; and
- Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and cockle Regulating Order).

Impact to hydrological and hydromorphological processes from temporary crossings of watercourses for access

- Watercourses crossed by temporary crossings which are monitored under WFD; have Q95<1m^3/s, and/or provide habitat for a protected species; and
- Watercourses crossed by temporary crossings which are not monitored under WFD; have Q95>0.001m^3/s, and do not provide habitat for a protected species.

Impacts to hydrological and hydromorphological processes from open cut crossing of watercourses

- Alltami Brook;
- Watercourses which are crossed by open cut methods with a Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species, including: Stanney Mill Brook, Seahill Tributary 2, Seahill Drain, Sandycroft Drain, Chester Road Drain North, Mancot Brook, Chester Road Brook Tributary 2, Willow Park Brook, New Inn Brook, Alltami Brook, Wepre Brook; and
- Watercourses which are crossed by open cut methods with Q95>0.001m^3/s not monitored under WFD, including: East Central Drain, West Central Drain, Hapsford Brook, Gale Brook, Thornton Uplands, Stanney Main Drain, Gowy Tributary 2, Rake Lane Brook,

Backford Brook, Friars Park Ditch, Finchetts Gutter Tributary, Sealand Main Drain/

Quantitative impacts to groundwater receptors

- Impacts to the groundwater levels and flows of groundwater receptors due to construction dewatering. This is a potentially significant effect on Principal aquifers, (superficial) Secondary A aquifers, (bedrock) Secondary A aquifers, groundwater abstractions and GWDTEs.

Water quality impacts to groundwater receptors

- Impacts to groundwater receptors from pollution. This is a potentially significant effect on Principal aquifers, Secondary A aquifers, groundwater abstractions and GWDTEs.

Impacts to flood risk

- Residents and users of the surrounding land – as a consequence of potential changes in the surface and groundwater regime caused by the construction works; and
- Construction workers – as a consequence of the risk associated to working in the floodplain, in proximity to blocked watercourses or in areas potentially affected by other forms of flooding.

Operational Stage

18.9.3. This section summarises those effects identified as significant during the Operational stage.

Impacts associated with loss of riparian vegetation along watercourse

- Alltami Brook;
- Backford Brook;
- Friars Park Ditch; and
- Finchetts Gutter Tributary.

Impacts to hydromorphological forms and processes due to channel and bank reinstatement following open cut crossings

- Alltami Brook;
- Watercourses which are crossed by open cut methods with a Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species, including: Stanney Mill Brook, Seahill Tributary 2, Seahill Drain, Sandycroft Drain, Chester Road Drain North, Mancot Brook, Chester Road Brook Tributary 2, Willow Park Brook, New Inn Brook, Alltami Brook, Wepre Brook; and
- Watercourses which are crossed by open cut methods with Q95>0.001m^3/s not monitored under WFD, including: East Central Drain, West Central Drain, Hapsford Brook, Gale Brook, Thornton

Uplands, Stanney Main Drain, Gowy Tributary 2, Rake Lane Brook, Backford Brook, Friars Park Ditch, Finchetts Gutter Tributary, Sealand Main Drain.

Impacts associated with the Newbuild Carbon Dioxide Pipeline buried beneath watercourses

- River Gowy

Impacts associated with installation of permanent artificial features within the channel of the watercourse

- Alltami Brook

Flood risk

18.9.4. An **FRA (Appendix 18.4 (Volume III))** and **FCA (Appendix 18.5 (Volume III))** have been produced in line with NPPF (**Ref. 18.17**) and TAN 15 (**Ref. 18.25**) to investigate flood risk and ensuring that appropriate mitigation measures are embedded in the proposals to mitigate flood risk through design while avoiding negative impacts elsewhere. The proposed drainage strategy at the AGI and BVS locations will control this runoff and discharge it at 2l/s which is the lowest rate practicable to avoid blockages (close to greenfield rate), therefore draining similar to existing conditions. The only exception is at Stanlow AGI which will not be restricted as it connects to the wider Stanlow site network. Therefore, no significant impacts during the Operational stage are expected.

Decommissioning Stage

18.9.5. The assessment of effects in **Appendix 18.2 - Assessment of Effects (Volume III)** concludes impacts to water quality during the decommissioning of AGIs and BVSs are likely to be similar to those expected during the Construction stage on watercourses not crossed by open trench methods. Therefore, the following impacts are considered significant:

Impacts to water quality and hydromorphology by entrainment of sediments

- Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and Cockle Regulating Order)

Impacts to water quality by spillage of pollutants

- River Dee; and
- Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and cockle Regulating Order).

18.10. MITIGATION AND ENHANCEMENT MEASURES

18.10.1. This section sets out the preliminary avoidance, mitigation and compensation measures which will be required to address the significant effects as assessed in **Section 18-9.**

CONSTRUCTION AND DECOMMISSIONING STAGE

18.10.2. A detailed CEMP will be prepared prior to commencement of construction works, as included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**). The controls and measures within the detailed CEMP will be implemented to mitigate against impacts during the Construction Stage. A Decommissioning Environmental Management Plan (DEMP) will be prepared for the Decommissioning Stage and is included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**). This document will include similar controls and measures to the detailed CEMP.

18.10.3. An **Outline Construction Environmental Management Plan (OCEMP) (Document Reference: D.6.5.4)** has been prepared for the DCO application which lists the controls and measures recommended to be adopted by the Construction Contractor during the Construction and Decommissioning Stage. A **REAC** (**Document Reference: D.6.5.1**) accompanies this ES, collating the mitigation relied upon in the EIA in order to manage the environmental impacts of the DCO Proposed Development.

18.10.4. The **REAC** (**Document reference: D.6.5.1**) includes mitigation measures for the Construction stage of the DCO Proposed Development which will be adopted by the Construction Contractor and embedded in the detailed CEMPs. These measures and controls are also presented in **Section 2 and Tables 4-1 to 4-19** of **Appendix 18.2 - Assessment of Effects (Volume III).**

Surface water and flood risk

18.10.5. Mitigation to minimise potential impacts during the Construction Stage to surface water and flood risk receptors is included within the **REAC (Document Reference: D.6.5.1)** (measures **D-WR-001** to **D-WR-032**).

Groundwater

Dewatering Management Plan

18.10.6. A Dewatering Management Plan is included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**) and will be produced by the Construction Contractor. It will provide a general framework for assessing the potential risks arising from dewatering, but also to act as a vehicle for

more specific and detailed assessment. The Dewatering Management Plan aims to keep the duration of pumping and the rates to a minimum which is achieved by minimising the required dewatering (**D-WR-035** of the **REAC, Document reference: D.6.5.1**). The Dewatering Management Plan will consider guidance from the Hydrogeological Impact Appraisal for Dewatering Abstractions (**Ref. 18.72**) and the Temporary Dewatering from Excavations to Surface Water (**Ref. 18.74**).

18.10.7. The Dewatering Management Plan will summarise all licences and permits to abstract and discharge from dewatering works issued by the Environment Agency and NRW (**D-WR-035** of the **REAC, Document reference: D.6.5.1**). Due to the temporary nature of the dewatering activities, an abstraction permit may not be required if the exemption requirements outlined by the Water Abstraction and Impounding Regulations 2017 (**Ref. 18.75**) are met. These are:

- the abstraction or series of abstractions are temporary and, in any event, carried out over a period of less than six consecutive months beginning with commencement of the first abstraction;
- each abstraction does not cause or is not likely to cause damage to a conservation site or specific features in such a site;
- each abstraction does not cause or is not likely to cause damage to protected species; and
- the volume of water abstracted is less than 100 cubic metres of water per day and there is no intervening use of that water before discharge.

18.10.8. NRW has outlined exemptions for Wales which include:

- abstractions of 20 cubic metres a day or less; and
- draining water (dewatering) to prevent interference with building or engineering works, where the abstraction lasts for less than 6 consecutive months, subject to restrictions.

18.10.9. Accounting for the exemption outlined above, it is expected that abstraction licences will be required for some dewatering locations across the DCO Proposed Development. These licences will be obtained prior to the works commencing.

18.10.10. In addition to permitting, the Dewatering Management Plan will include a detailed description of the main discharge points, abstraction and discharge rates, equipment used and construction sequence, any authorisation and details of any pre-treatment required prior to discharge approved by the Environment Agency.

Groundwater Management and Monitoring Plan

18.10.11. A Groundwater Management and Monitoring Plan (GWMMP) is included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**) and will be implemented alongside the detailed CEMP (produced by Construction Contractor) as part of the Environmental Management Plans. The GWMMP will detail the groundwater monitoring strategy where any dewatering activities are proposed and ensure all groundwater abstracted through construction is appropriately managed. The GWMMP will consider mitigation guidance for GWDTE from 'LA 113 Road drainage and the water environment' (**Ref. 18.30**) to ensure minimal loss of groundwater quantity from the water environment. The GWMMP will consider:

- Collection of groundwater level data pre-construction to provide a baseline, and during construction and operation to assess whether dewatering or the Newbuild Carbon Dioxide Pipeline have significantly impacted groundwater flow during construction and operation;
- Reduction in the use of damaging construction methods to aquifer physical properties such as consolidating;
- Provision of (compensatory) discharges to GWDTEs or use of water recycling during dewatering to support water level and flows where these may be reduced;
- Provision of monitoring of water levels in nearby wells or surface water to enable/ identify further mitigation measures when needed.
- Collection of baseline groundwater quality samples to identify trends and determine trigger levels, where possible.

18.10.12. The GWMMP will establish a protocol for the assessment and response to monitoring data and provide methods to assess compliance with the conditions of development consents, environmental protection licences and legislation relating to groundwater and GWDTE.

18.10.13. An abandoned mine entry was found situated a short distance (~10 m) to the north of the DCO Proposed Development at trenchless crossing TRS-41. **Chapter 11 – Land and Soils (Volume II**) states that shallow coal mining related issues are to be assessed and addressed in line with best practice guidance (CIRIA C758D Abandoned Mine Workings Manual) (**Ref. 18.77**).

OPERATION STAGE

18.10.14. A **REAC** (**Document Reference: D.6.5.1**) accompanies this ES, collating the mitigation relied upon in the EIA in order to manage the environmental impacts of the DCO Proposed Development.

18.10.15. The **REAC** (**Document reference: D.6.5.1**) includes mitigation measures for the Operation stage of the DCO Proposed Development which will be adopted through the Detailed Design or the operational methodologies.

These measures and controls are also presented in **Section 2** and **Tables 4-1 to 4-19** of **Appendix 18.2 - Assessment of Effects (Volume III**).

18.11. RESIDUAL EFFECTS

18.11.1. **Table 18.15** below summarises the residual effects associated with the DCO Proposed Development during Construction, Operation and Decommissioning stages.

Table 18.15 - Summary of Residual Effects

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
Construction				
Impacts to water quality (turbidity)	Shropshire Union Canal, River Dee	***Moderate Adverse (Significant)***	Implementation of a detailed CEMP including measures **D-WR-001** to **D-WR-032** outlined in the **REAC** (**Document Ref: D.6.5.1**)	*Slight Adverse (Not Significant)*
	Watercourses which are crossed by open cut methods with a Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species.	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Watercourses which are crossed by open cut methods with Q95>0.001m^3/s not monitored under WFD	***Moderate Adverse (Significant)***		*Neutral (Not Significant)*
	Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and cockle Regulating Order)	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Groundwater quality- Principal aquifer (SSG)	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Groundwater quality- Secondary A aquifers	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Groundwater associated users (local groundwater abstractions)	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	GWDTE and peat	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
Impacts to water quality by spillage of pollutants	River Dee	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Watercourses which are crossed by open cut methods with a Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species.	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Watercourses which are crossed by open cut methods with Q95>0.001m^3/s not monitored under WFD	***Moderate Adverse (Significant)***		*Neutral (Not Significant)*
	Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and cockle Regulating Order)	***Large Adverse (Significant)***		*Slight Adverse (Not Significant)*
Impacts to hydrological and hydromorphological processes from temporary crossings of watercourse for access	Watercourses crossed by temporary crossings which are: Monitored under WFD; have Q95<1m^3/s, and/or provide habitat for a protected species.	***Moderate Adverse (Significant)***	Use of bio-textiles to stabilise fill material (**D-BD-060** of the **REAC, Document reference: D.6.5.1).** Temporary blockage of watercourse during construction and use of sediment boom.	*Slight Adverse (Not Significant)*
	Watercourses crossed by temporary crossings which are: Not monitored under WFD; have Q95>0.001m^3/s, and do	***Moderate Adverse (Significant)***		*Neutral (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
	not provide habitat for a protected species.		Turbidity monitoring (**D-WR-044** of the **REAC, Document reference: D.6.5.1**)	
Impacts to hydrological and hydromorphological processes from open cut crossings of watercourses	Alltami Brook	***Moderate Adverse (Significant)***	**D-WR-046** of the **REAC, Document reference: D.6.5.1**. Relevant permits to be obtained for work on ordinary watercourses and main rivers (**D-WR-033** of the **REAC, Document reference: D.6.5.1**). Channel and banks to be reinstated to mimic the baseline conditions. This includes reinstatement of an appropriate vegetation assemblage (**D-BD-032** of the **REAC, Document reference: D.6.5.1**). **D-WR-028** of the **REAC, Document reference: D.6.5.1**. Minimal working width to be adopted as far as practicable (**D-BD-018** of the	***Moderate Adverse (Significant)***
	Watercourse with Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Watercourses with Q95>0.001m^3/s not monitored under WFD	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			REAC, Document reference: D.6.5.1). Detailed design alignment of the pipeline to be determined to minimise potential impacts (**D-PD-004** of the **REAC, Document reference: D.6.5.1**). Where practicable, removed habitats to be replaced (**D-BD-049** of the **REAC, Document reference: D.6.5.1**). Minimal working width to be adopted as far as practicable. 16m maximum working width within the Alltami Brook (**D-WR-063** of the **REAC, Document reference: D.6.5.1**).	
Quantitative impacts to groundwater receptors	(Superficial) Secondary A aquifers	***Moderate Adverse (Significant)***	Implementation of a detailed CEMP including measures **D-WR-001** to **D-WR-032, D-WR-035** and **D-WR-036** of the **REAC, Document reference: D.6.5.1.**	*Slight Adverse (Not Significant)*
	(Bedrock) Secondary A aquifers (PCMG) PCMG	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*

Description of the effect	Receptor		Preliminary assessment of likely effects	Mitigation measure	Residual effect
	Groundwater abstractions		***Moderate Adverse (Significant)***		*Neutral (Not Significant)*
Groundwater quality impacts	Principal Aquifer	SSG	***Moderate Adverse (Significant)***	Implementation of a detailed CEMP including measures **D-WR-001** to **D-WR-032** outlined in the **REAC** (**Document Ref: D.6.5.1**). Compliance with standard pollution prevention measures	*Slight Adverse (not significant)*
					Slight Adverse (not significant)
	(Superficial) Secondary A aquifers		***Moderate Adverse (Significant)***		*Slight Adverse (not significant)*
	Groundwater abstractions		***Moderate Adverse (Significant)***		*Slight Adverse (not significant)*
	GWDTE		***Moderate Adverse (Significant)***		*Slight Adverse (not significant)*
Impact to flood risk	Residents and users of the surrounding land		***Moderate Adverse (significant)***	Implementation of a detailed CEMP including measures **D-WR-001** to **D-WR-032** outlined in the **REAC** (**Document Ref: D.6.5.1**). Including implementation of a Construction Flood Action Plan and signing up for flood warnings (**D-WR-041** of the	*Slight (Not Significant)*
	Construction Workers		***Moderate Adverse (Significant)***		*Neutral (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			REAC, Document reference: D.6.5.1). **D-WR-001** of the **REAC, Document reference: D.6.5.1.** Where possible, timing of construction activities will avoid high flow events and heavy rainfall (**D-WR-030** of the **REAC, Document reference: D.6.5.1**). Monitoring of flows and rainfall within the upstream catchment will be undertaken and action taken to halt works should high flows be anticipated due to prevailing weather conditions (**D-WR-032** of the **REAC, Document reference: D.6.5.1**).	
Operation				
Impacts associated with loss of riparian vegetation along watercourse	Alltami Brook	***Moderate Adverse (Significant)***	**D-BD-060, D-BD-048** and **D-WR-052** of the **REAC, Document reference: D.6.5.1**.	*Slight Adverse (Not Significant)*
	Backford Brook, Finchetts Gutter	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			Additional riparian planting on Friars Park Ditch, Backford Brook and Finchetts Gutter Tributary, where practicable (**D-WR-062** of the **REAC, Document reference: D.6.5.1**).	
Impacts to hydromorphological forms and processes due to channel and bank reinstatement following open cut crossings	Alltami Brook	***Moderate Adverse (Significant)***	**D-BD-048 and D-BD-060** of the **REAC, Document reference: D.6.5.1**. For the Alltami Brook, a bespoke geomorphological assessment will be carried out by the Construction Contractor to inform: micro-siting the crossing location of the pipe so that the least sensitive section of river bed is permanently impacted, where practicable; and the Detailed Design of the permanent works installed as part of the reinstatement of the watercourse after pipe is laid (**D-WR-066** of the	*Slight Adverse (Not Significant)*
	Watercourse with Q95<1m^3/s. Monitored under WFD and provide habitat for a protected species	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Watercourses with Q95>0.001m^3/s not monitored under WFD	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			REAC, Document reference: D.6.5.1). At most a length of 4m of the bed of the Alltami Brook will be removed and replaced with artificial material (**D-WR-063** of the **REAC, Document reference: D.6.5.1**). Geomorphological and ecological monitoring of the permanent works will be carried out, post construction, to identify any potential failure of the permanent works which will lead to a significant impact to the water environment and aquatic habitat. Adaptive mitigation will be implemented to prevent deterioration from occurring (**D-WR-065** of the **REAC, Document reference: D.6.5.1**).	
Impacts associated with the Newbuild	River Gowy	***Moderate Adverse (Significant)***	Construction Contractor will undertake further	*Neutral (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
Carbon Dioxide Pipeline buried beneath watercourses			engagement with the Environment Agency Planning and Geomorphology Technical Specialists during the Detailed Design process to determine the required floodplain extent required for pipeline burial depth below the existing river bed level to allow for this WFD Mitigation Measure to be achieved (**D-WR-055** of the **REAC, Document reference: D.6.5.1**).	
Impacts associated with installation of permanent artificial features within the channel of watercourses	Alltami Brook	***Moderate Adverse (Significant)***	A bespoke geomorphological assessment will be carried out by the Construction Contractor to inform: • micro-siting the crossing location of the pipe so that the least sensitive section of river bed is permanently impacted, where practicable,	*Slight Adverse (Not Significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			• the Detailed Design of the permanent works installed as part of the reinstatement of the watercourse after pipe is laid Further engagement with Natural Resources Wales and the Lead Local Flood Authority Planning will be undertaken to inform the methodology of this bespoke geomorphological assessment (**D-WR-066** of the **REAC, Document reference: D.6.5.1**). At most a length of 4m of the bed of the Alltami Brook will be removed and replaced with artificial material (**D-WR-065** of the **REAC, Document reference: D.6.5.1**). Geomorphological and ecological monitoring of the permanent works will be carried out, post	

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			construction, to identify any potential failure of the permanent works which will lead to a significant impact to the water environment and aquatic habitat. Adaptive mitigation will be implemented to prevent deterioration from occurring (**D-WR-065** of the **REAC, Document reference: D.6.5.1**).	
Impacts to groundwater levels and flows	Principal aquifer	*Slight adverse (not significant)*	**D-WR-039** of the **REAC, Document reference: D.6.5.1**.	*Slight adverse (not significant)*
	(Superficial) Secondary A aquifer	*Slight adverse (not significant)*		*Slight adverse (not significant)*
	(Bedrock) Secondary A aquifer	*Neutral (not significant)*		*Neutral (not significant)*
	GWDTE	*Slight adverse (not significant)*		*Slight adverse (not significant)*
	Groundwater abstractions	*Neutral (not significant)*		*Neutral (not significant)*
Impacts to groundwater quality	Principal aquifer	*Slight adverse (not significant)*	Visiting vehicles will take a spill kit in case of emergency and spill kits will be stored in the kiosks at AGIs and BVSs (**D-WR-057** of the **REAC, Document reference: D.6.5.1**). **D-WR-039** of the **REAC, Document**	*Slight adverse (not significant)*
	(Superficial) Secondary A aquifer	*Slight adverse (not significant)*		*Slight adverse (not significant)*
	(Bedrock) Secondary A aquifer	*Neutral (not significant)*		*Neutral (not significant)*
	GWDTE	*Slight adverse (not significant)*		*Slight adverse (not significant)*

Description of the effect	Receptor	Preliminary assessment of likely effects	Mitigation measure	Residual effect
			reference: D.6.5.1. Leak detection systems of pipeline will identify any leakage.	
Decommissioning				
Impacts to water quality (turbidity)	Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and Cockle Regulating Order)	***Moderate Adverse (Significant)***	Implementation of a detailed CEMP including measures **D-WR-001** to **D-WR-032** outlined in the **REAC** (**Document Ref: D.6.5.1**).	*Slight Adverse (Not Significant)*
Impacts to water quality by spillage of pollutants	River Dee	***Moderate Adverse (Significant)***		*Slight Adverse (Not Significant)*
	Dee Estuary Special Protection Area and Mersey Estuary Site of Special Scientific Interest (including Shellfish Water and cockle Regulating Order)	***Large Adverse (Significant)***		*Slight Adverse (Not Significant)*

18.12. IN-COMBINATION CLIMATE CHANGE IMPACTS

18.12.1. Climate change impacts associated with the water environment are considered for the Operational stage of the DCO Proposed Development. The BVSs and AGIs will be served by the drainage system which is designed to accommodate climate change. The pipeline is below ground and therefore not at risk of climate change effects on the water environment and flood risk.

18.12.2. NRW and the Environment Agency has committed to maintaining the standard of protection for the coastal flood defences throughout the next 100 years according to the latest Shoreline Management Plans (**Ref. 18.76**).

18.13. MONITORING

18.13.1. As part of mitigation the following will be adopted which have a monitoring requirement:

- A Surface Water Management and Monitoring Plan is included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**);
- Turbidity Monitoring (**REAC Reference D-WR-044**);
- A Groundwater Management and Monitoring Plan is included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**).**;**
- A Dewatering Management Plan is included as a Requirement of the **Draft DCO** (**Document Reference: D.3.1**); and
- Geomorphological and ecological monitoring of the permanent works at Alltami Brook to identify any potential failure of the permanent works which could lead to a significant impact to the water environment and aquatic habitat. Type, duration and frequency of monitoring is to be determined through the development of the geomorphological assessment and Detailed Design, and in consultation with NRW and FCC LLFA (**REAC Reference D-WR-065**).

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