HyNet North West Hydrogen Pipeline

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Appendix 7D

Assessment of Water Environment Effects

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1. Overview

1.1.1 This appendix presents an assessment of water environmental (including flood risk) effects due to the construction, operational and decommissioning phases of the Project.

1.1.2 The construction phase of the Project includes all activities that are required to construct the sub-surface pipeline and install the Hydrogen Above Ground Infrastructures (HAGIs) and other surface infrastructure including Block Valve Installations (BVIs). Construction would comprise the excavation of trenches (open cut and trenchless installation techniques) for the installation of the pipeline along the route.

1.1.3 A range of options are identified for the trenchless crossings identified in **Chapter 2: The Project**. The Draft Order Limits have been developed to include areas for pipe and other material storage ('material storage areas') along the corridors. A reasonable worst-case assessment of the various potential effects of construction has been completed to ensure that the various pipeline corridor options and HAGI locations have been fully taken into account.

1.1.4 During the operational phase, potential effects on the water environment would be much reduced compared to construction. The pipeline network would be built to distribute hydrogen and so there is unlikely to be a risk of pollution to the water environment should there be a pipeline leak during the operational phase. Furthermore, embedded environmental measures, including maintenance procedures and adoption of standard good practice measures, would ensure that pollution of the water environment is avoided during maintenance.

1.1.5 Decommissioning effects are likely to be similar to construction effects but, given the intention to leave the pipeline within the ground, of a lesser magnitude and spatial extent. On the basis that construction effects can generally be satisfactorily mitigated by embedded measures, it is anticipated that this would be also true for decommissioning phase works. However, these effects would need to be subject to full assessment at the appropriate time when detailed proposals are put forward and would take place in accordance with the baseline and regulatory context prevailing at the time of the decommissioning works.

2. Construction Phase

2.1 Overview

2.1.1 The pipeline would be a multi-diameter pipeline transportation network and as such each section would have a specific temporary working pipeline construction corridor width. As an example, for a maximum 42" pipeline the working width would be expected to be a minimum of 36m. A wider working width, known as a box-out section, would be required in some instances e.g. at crossings including trenchless crossings and where the pipeline route changes direction. This is to facilitate safe working, additional spoil storage and equipment laydown. Access tracks would also be constructed to facilitate the movement of construction vehicles and plant.

2.1.2 Whilst the target excavation depth of the pipeline trench would be on average 2.5-3m, the trench may be set deeper particularly where the pipeline is 42" in diameter. Also, where the pipeline passes beneath services and other crossings (including watercourses) it may be approximately 6m deep, with trenchless crossings being significantly deeper still.

2.1.3 Access tracks would generally be installed with aggregate along the designated route, following initial topsoil stripping activities. Pipeline crossings of watercourses would be achieved using a variety of methods including open cut, auger bore, micro tunnel and Horizontal Directional Drilling (HDD). Temporary haul road watercourse crossings would also be required for construction access in some areas.

2.1.4 The works would require a number of temporary construction compounds, which would also require topsoil stripping to provide a suitable area and the laying of aggregate. Temporary construction compound areas would include storage of material, waste and equipment and would also be equipped with welfare facilities. They would typically be located at HAGI and BVI locations.

2.1.5 For the purposes of the assessment, the entire HAGI footprint is assumed to be between 0.5ha to 1.5ha. BVI compounds would typically be less than 0.5ha in area. Additional areas would also be required to support construction. The foundations would necessitate excavations and may require piling depending on ground conditions, the requirements of which would be specified after preliminary Ground Investigation (GI) works are completed.

2.1.6 The pipeline corridors, locations of HAGIs and BVI and Draft Order Limits for construction have been specified to avoid sensitive environmental features and engineering constraints. Water environment constraints considered in this exercise include the presence of major watercourses and the distribution of tidal and various inland flood zones.

2.1.7 A key area of potential concern for this assessment relates to the pipeline watercourse crossings. Potential interactions with the crossings have been identified along the pipeline corridors and given careful consideration during the

design process, as documented within the draft crossing schedule shown in **Chapter 2: The Project, Appendix 2B**[1]. Watercourse crossings would also be required for temporary construction access routes.

2.1.8 A number of embedded environmental measures have been specified to minimise potential effects on water environment receptors during all project phases, but particularly during construction (including the crossings), when the greatest potential for effects is considered to occur. These mitigation measures are summarised in **Chapter 7: Water Environment - Table 7.16.**

2.1.9 The Draft Order Limits lie within the catchments of the Weaver Gowy, Lower Mersey and Upper Mersey identified in **Chapter 7: Water Environment - Section. 7.5.** Therefore, each of the water environment receptors that were screened in for assessment in **Chapter 7: Water Environment - Table 7.17** has a potential connection to the pipeline construction corridor. For the purpose of clear presentation, the receptors have been grouped into their generic types within the assessment.

2.1.10 The range of the sensitivity, magnitude and significance definitions for each receptor and potential effect are provided within **Chapter 7: Water Environment - Table 7.20, Table 7.21** and **Table 7.22**respectively. The magnitude and the significance of effects have been assessed on the assumption that the embedded environmental measures are effectively implemented.

2.1.11 The assessment is presented on a potential effect-by-effect basis in the subsequent discussion and applies for all sections of pipeline (for all options) and HAGI and BVI locations, with specific areas of interest being highlighted within the narrative. **Chapter 7: Water Environment – Table 7.23** provides a summary of the assessment of the potentially adverse effects on the water environment.

2.2 Assessment of the Potentially Adverse Effects on the Water Environment from Construction Activities

2.2.1 The assessment of water environment effects from construction activities is given within the following sections.

Deterioration in the water quality of surface water bodies via generation of sediment laden run-off from working areas and discharge of dewatered groundwater from excavations

2.2.2 Without appropriate mitigation measures in place, construction activities would have the potential to lead to the release of silt-laden or otherwise contaminated runoff into watercourses and other surface water bodies. Such releases could be due to ground disturbance in working areas and also as a result of the discharge of dewatered groundwater from excavations. The resulting contamination would increase the turbidity within the receiving watercourses and would have

[1] HyNet North West Hydrogen Pipeline FEED - Pipeline Crossing Schedule, May 2022, Cadent Gas. HYN02-PL-SCH-WDG-0000-0001 Rev: A02

detrimental impacts on both water quality and aquatic ecology. The mitigation of the release of silt-laden water also prevents against any silt build up in canals and within below-canal culverts.

2.2.3 Watercourse crossings are one such potentially contaminating work activity. Where trenchless methods are used there would be no works within a channel and effects would be limited. However, trenched crossings of surface water bodies have the greatest magnitude of effects due to the works being in close proximity to, and even within, the channels (see the receptors highlighted with an asterisk within **Table 7D.1**), with for instance sediments and associated nutrients and other contaminants becoming mobilised within the surface flow and transported downstream.

2.2.4 To lessen effects works within the flood defences of the Moderate Sensitivity River Mersey will be minimised, and all Medium Sensitivity canals would be crossed using trenchless methods. Furthermore, a range of measures are proposed in **Chapter 7: Water Environment - Table 7.16** that would mitigate against the mobilisation of sediments. The details of these measures would be developed during construction planning as part of the Drainage and Water Management Plan (DWMP), Watercourse Crossing Plan (WCP) and Construction Environmental Management Plan (CEMP), preparation of which would be secured via a Development Consent Order (DCO) requirement. Any discharge of water from dewatering operations into canals or Canal Trust owned waterways would be subject to the Trust's agreement.

2.2.5 As one of these measures, turbidity monitoring would be undertaken by an Ecological Clerk of Works (ECoW) during the construction stage where it is deemed to be required based on the sensitivity of local aquatic species receptors. The need and frequency of turbidity monitoring would be determined by the regulatory authority and detailed in any required permits for undertaking work within or near watercourses. Even where watercourses are located downstream of watercourse tributaries crossed by open cut methods, dispersion within downstream flows would reduce impacts. Embedded mitigation strategies adopted to avoid impacts on fisheries and other aquatic receptors are provided within **Chapter 5: Biodiversity**.

2.2.6 During consultation with the Environment Agency (**Appendix 7A**) it was agreed that open cut methodologies at watercourse crossings on Main Rivers with a hydromorphology conservation values higher than 4 were of particular interest and sensitivity e.g. the Puddinglake Brook and Cogshall Brook (Whitley Brook) WFD surface water bodies. With comprehensive embedded measures implemented general project construction activities are assessed to cause a Negligible - Low magnitude change in the ingress of sediments and associated nutrients and contaminants into these and other WFD surface water bodies with a Medium Sensitivity. Effects even on a trenched watercourse are therefore considered **Negligible - Minor** (**Not Significant)** (**Table 7D.1**).

2.2.7 In the specific case of trenched crossings of Low Sensitivity non-reportable WFD surface water bodies, Ordinary Watercourses and minor watercourses and ditches, it is recognised that works in and immediately around these smaller watercourses have a heightened risk of suspended sediment ingress or direct

disturbance of channel bed and bank sediments, although these risks would still be temporary and localised. The magnitude of this change is assessed as being Low and the effect **Negligible** (**Not Significant**) (**Table 7D.1**), on the basis that the relevant embedded measures in **Chapter 7: Water Environment – Table 7.16** would be implemented via the WCP and CEMP.

Table 7D.1 Summary of effects: Deterioration in the water quality of surface water bodies via generation of sediment laden run-off from working areas and discharge of dewatered groundwater from excavations

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
WFD Surface Water Bodies	Medium	*Mersey* *Sinderland Brook** *Whittle Brook (Mersey Estuary)* *Sutton Brook** *Weaver (Dane to Frodsham)** *Mersey/ Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin)* *River Weaver (Barnet to Valley Brook)* *River Weaver (Valley Brook to Winsford Flashes)* *River Weaver (Winsford Flashes to Dane)* *Bollin (Ashley Mill to Manchester Ship Canal)** *Dane (Wheelock to Weaver)* *Gale Brook** *Puddinglake Brook** *Bogart Brook* *Cuddington Brook* *Wade Brook* *Peckmill Brook**, *Hoolpool Gutter at Ince Marshes water body*	**Overall design:** **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-8**: Silt management measures **C-9**: Stand-off distances from watercourses, flood defences and water supply / sewerage infrastructure **C-10**: Timely reinstatement following completion of works **C-11**: Permitting of discharges **C-12**: Discharge outfall design **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-28**: Temporary construction access watercourse crossings	Negligible - Low	Negligible - Minor (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		*Arley Brook (Source to Gale Brook)** *Keckwick Brook* *Cogshall Brook** *Mersey (Bollin confluence to Howley Weir) including Padgate Brook* *Hardshaw (Windle) Brook* *Weaver Navigation (canal section Frodsham to Weston Point Docks)* *Bridgewater Canal* *Manchester Ship Canal* *Sankey Canal* *Trent and Mersey Canal, summit to Preston Brook Tunnel*			
Surface Water Bodies	Low	*Non-reportable WFD surface water bodies* *Ordinary Watercourses* *Minor watercourses and ditches*	**Overall design:** **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-8**: Silt management measures **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-10**: Timely reinstatement following completion of works **C-11**: Permitting of discharges **C-12**: Discharge outfall design	Low	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
			Construction - watercourse crossings: **C-25**: WCP **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings		

Notes: * WFD surface water bodies that are proposed to have trenched watercourse crossings.

Deterioration in the water quality of surface and groundwater bodies due to accidental contamination entering groundwater or watercourses, associated with spillage or leakage of fuels, lubricants or other chemicals/pollutants

2.2.8 There is the potential for accidental contamination entering groundwater or watercourses associated with spillage or leakage of fuels, lubricants or other chemicals (including the potential for leakage of bentonite during HDD) during construction. Such contamination would increase the levels of pollutants within the receiving water bodies and associated abstractions and have detrimental impacts on both water quality and aquatic ecology.

2.2.9 To lessen effects works within the flood defences of the Medium Sensitivity River Mersey will be minimised, meaning limited hydrological connection from nearby working areas is anticipated. Any components that may require separate bunding to isolate high pollution risk areas will be assessed during detailed design stage. Furthermore, the majority of the Low Sensitivity licensed non-public surface water abstractions are outside of the Draft Order Limits and/or over 500m downstream from the proposed works and dilution effects would reduce any potential impacts.

2.2.10 The exceptions are the surface water abstractions at Heath Hall Farm (Licence Number: 2568003097) at NGR SJ 612 781 on the Whitley Brook, 132m downstream of the proposed trenched crossing point, and the abstraction at Sinderland Green, Dunham Massey, Altrincham (Licence Number: 2569017033) at NGR SJ 729 890 on the Caldwell Brook and within the Draft Order Limits, although the proposed crossing is likely downstream at this location. In such close proximity, with lack of possible dilution effects there is the potential for accidental contamination entering watercourses associated with spillage or leakage of fuels, lubricants or other chemicals during construction. Therefore, as part of the Pollution Prevention Plan (PPP) a watching brief will be included to protect these abstraction localities.

2.2.11 For all receptors, a range of measures are proposed in **Chapter 7: Water Environment - Table 7.16** that would mitigate against accidental contamination. The details of these measures will be developed during construction planning as part of the DWMP, CEMP and associated PPP and Material Management Plan (MMP). Where receptors are particularly close to working areas, for example at watercourse crossings and associated haul roads, specific mitigation would be in place and a WCP will be developed prior to commencement of construction works.

2.2.12 Where subsurface pathways to groundwater receptors need to be better defined, for example at HDD crossings, a specific screening exercise within **Appendix 7B** has been undertaken to establish groundwater receptor vulnerability, and robust mitigation strategies (**Chapter 7: Water Environment - Table 7.16**) have been developed to protect abstractions and/or aquifers, particularly for receptors close to HDD crossings where excavations would be deeper within the subsurface and/or closer to watercourses. Bentonite breakout associated with HDD works would be

mitigated through the assessment of risks and borehole design prior to drilling e.g. casing out prominent fractures. Additional mitigation would include the monitoring of mud volumes and downhole annular pressures during drilling that may indicate that losses were occurring so that drilling can stop, and corrective measures put in place. Appropriate method statements would detail works and emergency responses.

2.2.13 In the case of High Sensitivity licensed public groundwater supplies, conceptual understanding of the sites suggests that pathways from shallow works are unlikely to exist. The Higher Walton public groundwater supply Source Protection Zone (SPZ) 3 catchment area is coincident within the Draft Order Limits. Since there is the potential for accidental contamination entering groundwater associated with spillage or leakage of fuels, lubricants or other chemicals (including the potential for leakage of bentonite during HDD) during construction and/ or change of groundwater levels ongoing consultation with the Environment Agency is to be undertaken prior to final ES submission to present the current conceptual understanding / proposed mitigation to protect this source.

2.2.14 A watching brief for the identification for potential subsurface pathways would nevertheless be included within the PPP for works within SPZs and any works would be carried out as close to the surface as practicable, during a dry period and in a short timeframe to minimise the likelihood of interaction with groundwater. Where HDD or micro-tunnelling are proposed within these SPZs, construction activities would be sited outside of the inner SPZ1s and SPZ2s, pre-construction GI would be used to refine the HDD/microbore design and no storage or refueling would be undertaken within any SPZ. Potential impacts arising from foul water discharges from construction worker facilities would be fully mitigated through the implementation of standard construction good practice measures and the appropriate treatment and disposal of sewage would be provided where no foul sewer is available to ensure protection of the water environment. Drainage strategies (**Appendix F: Flood Risk Assessment – Annex 7F6 Outline Drainage Strategy**) for the Project have been produced detailing how surface water would be managed. Should discharge of treated effluent to watercourses or to land be required, this would be subject to an Environmental Permit.

2.2.15 With the application of comprehensive embedded measures the effect of contamination on the Medium Sensitivity WFD surface water bodies, Low Sensitivity non-reportable WFD bodies, Ordinary Watercourses and Medium Sensitivity WFD groundwater bodies is considered to be of Negligible. Effects are therefore considered to be **Negligible** (**Not Significant**) (**Table 7D.2**).

2.2.16 In the same way, the effect of contamination on the associated High and Low Sensitivity abstractions, namely licensed public groundwater supplies and licensed non-public groundwater and surface water abstractions/deregulated abstractions is regarded as of Negligible and **Minor (Not Significant)** and **Negligible (Not Significant)** (**Table 7D.2**) respectively.

2.2.17 The licensed non-public groundwater borehole at Peterhouse Farm, Gorsey Lane, Warburton is used for an agricultural supply and located with the Draft Order Limits. A specific risk assessment and mitigation strategy such as a monitoring and inspection programme should be developed for this supply. This can be secured via a DCO requirement.

Table 7D.2 Summary of effects: Deterioration in the water quality of surface and groundwater bodies due to accidental contamination entering groundwater or watercourses, associated with spillage or leakage of fuels, lubricants or other chemicals/pollutants

Receptor groups	Sensitivity	Receptor[+]	Embedded environmental measures	Magnitude of effect	Significance of effect
WFD Surface Water Bodies	Medium	*Mersey* *Sinderland Brook*[*] *Whittle Brook (Mersey Estuary)* *Sutton Brook*[*] *Weaver (Dane to Frodsham)*[*] *Mersey/Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin)* *River Weaver (Barnet to Valley Brook)* *River Weaver (Valley Brook to Winsford Flashes)* *River Weaver (Winsford Flashes to Dane)* *Bollin (Ashley Mill to Manchester Ship Canal)*[*] *Dane (Wheelock to Weaver)* *Gale Brook*[*] *Puddinglake Brook** *Bogart Brook* *Cuddington Brook* *Wade Brook* *Peckmill Brook*, Hoolpool Gutter at Ince Marshes water body* *Arley Brook (Source to Gale Brook)*[*]	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance **C-16**: Handling and processing of concrete **C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		Keckwick Brook *Cogshall Brook** *Mersey (Bollin confluence to Howley Weir) including Padgate Brook* *Hardshaw (Windle) Brook* *Weaver Navigation (canal section Frodsham to Weston Point Docks)* *Bridgewater Canal* *Manchester Ship Canal* *Sankey Canal* *Trent and Mersey Canal, summit to Preston Brook Tunnel*			
Surface Water Bodies	Low	*Non-reportable WFD bodies* *Ordinary Watercourses* *Minor watercourses and ditches*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance **C-16**: Handling and processing of concrete **C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
			Construction - watercourse crossings: **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings		
WFD Groundwater Bodies	Medium	*Wirral and West Cheshire Permo-Triassic Sandstone Aquifers* *Weaver and Dane Quaternary Sand and Gravel Aquifers* *Manchester and East Cheshire Permo-Triassic Sandstone Aquifers* *Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers* *Sankey and Glaze Carboniferous Aquifers*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance **C-16**: Handling and processing of concrete **C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings	Negligible	Negligible (**Not Significant**)
Licensed Public Groundwater Supplies	High	*Higher Walton* *Daresbury* *Eccleston Hill*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works	Negligible	Minor **(Not Significant)**

Receptor groups	Sensitivity	Receptor[+]	Embedded environmental measures	Magnitude of effect	Significance of effect
		Bold Heath *Broomedge*	**C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance **C-16**: Handling and processing of concrete **C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings **C-29:** Managing groundwater risk during HDD		
Licensed Non-Public Groundwater Abstractions	Low	*(A1 Borehole at Peterhouse Farm, Gorsey Lane, Warburton)* *(A65 Well at Dairy Farm, High Legh, Knutsford)* *(A48 Well at Aston Grange, Preston Brook)* *(A4 to A7; A9 to A13; A25 to A33 and A51 to A56 Boreholes X 6 At Warrington and Penketh Cheshire - Wells 1,2, 5,6, 11 and 12)* *(A49 Borehole at Premises at Rocksavage Works, Runcorn)*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance	Negligible	Negligible **(Not Significant)**

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		(A57 – A62 Borehole No 7 At Thornton-Le-Moors and Stanlow, Ellesmere Port) *(A44 Borehole at Gatewarth Ind. Estate, Sankey Bridges, Warrington)* *(A8 AO Plant Wells, Solvay Interox Ltd.)* *(A34 – A43 5 Boreholes at Fiddlers Ferry Power Station, Widnes)* *(A45 Borehole near premises at Moorfield Road, Widnes)* *(A84 Borehole at Mersey Bank Farm, Hapsford, Helsby)* *(A2, A3 Borehole at Broad Oak Farm, Warburton Lymm)* *(A24 Borehole at Blackstone Farm, Lower Whitley, Daresbury)*	**C-16**: Handling and processing of concrete **C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings		
Licensed Non-Public Surface Water Abstractions	Low	*A116 Bridgewater Canal at Agden, Lymm* *A117 River Bollin at Agden* *A118 River Bollin at Heatley* *A120 Caldwell Brook at Sinderland Green* *A121 Sinderland Brook at Warburton, Lymm, and Dunham Massey* *A122 Sinderland Brook at Sinderland Green, Dunham Massey* *A123 Bridgewater Canal at Agden* *A125 Rookery Pool at Vale Royal Abbey*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-9**: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance **C-16**: Handling and processing of concrete	Negligible	Negligible **(Not Significant)**

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		A126 Pettypool Brook at Whitegate *A127 River Weaver at LH's premises* *A128 River Bollin at Warburton, Lymm* *A129 River Bollin at Warburton, Lymm* *A130 Petty Pool, Sandiway fed by unnamed tributaries of the River Weaver* *A132 Cliff Brook at Acton Bridge* *A133 Acton Brook at Weaverham* *A134, A135 River Weaver at premises, Winnington (two abstractions)* *A136 River Weaver Navigation at Saltersford Lock* *A137 Anderton Boat Lift* *A139 Whitley Brook at Heath Hall Farm* *A140 Hydropower Intake - Dutton Sluices* *A141 Whitley Brook (tributary) at Heath Hall Farm* *A143, A144 Unnamed Watercourse feeding a pond at Daresbury Farm,* *A145, A146 River Mersey at Bank Quay (two abstractions)*	**C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings		

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		A148 Weston Canal (Weaver Navigation) at Pumping Station, Frodsham *A149 Weston Canal at Sutton, Runcorn [ICI]* *A150, A151 Weston Canal at Weston Point Runcorn Cheshire (two abstractions)* *A152, A153 Manchester Ship Canal at Weston Point, Runcorn (two abstractions)* *A154, A155 2569025077, St. Helens Canal at St. Helens, Merseyside* *A156 Red Brook at Warburton, Lymm, Cheshire* *A157, A161, A162 Manchester Ship Canal at Ellesmere Port (three abstractions),* *A158, A159 Manchester Ship Canal at Ellesmere Port (two abstractions)* *A160 Inland Water - Thornton Brook at Stanlow* *A163 Manchester Ship Canal, Partington*			
Deregulated Abstractions	Low	*A165 borehole at Mersey Bank Farm, Hapsford, Helsby* *(A170 borehole at Peterhouse Farm, Gorsey Lane, Warburton)*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations	Negligible	Negligible **(Not Significant)**

Receptor groups	Sensitivity	Receptor[+]	Embedded environmental measures	Magnitude of effect	Significance of effect
			C-9: Stand-off distances from watercourses, flood defences and water supply/ sewerage infrastructure **C-11**: Permitting of discharges **Construction - pollution prevention:** **C-13**: PPP **C-14**: Storage of hydrocarbons and other chemicals: **C-15**: Refuelling, inspection and maintenance **C-16**: Handling and processing of concrete **C-17**: Measures to avoid pollution impacts from disturbance of contaminated land (MMP) **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-28**: Temporary construction access watercourse crossings		

Notes: * WFD surface water bodies that are proposed to have trenched watercourse crossings.

+ Licensed non-public groundwater abstraction and de-regulated abstraction receptors within brackets are inside or within 500m of the Draft Order Limits. All other receptors within the list are over 500m and less than 1.5km from the Draft Order Limits.

Impacts on groundwater levels and/or hydrogeological flow regimes from the dewatering of trenched or trenchless excavations for pipeline and/or the effects of underground infrastructure due to barriers to flow and/or the development of less permeable access track or temporary construction compound establishment reducing infiltration

2.2.18 The potential decline in groundwater levels and/or the change in groundwater flow regimes have the potential to impact aquifers and water resource receptors such as abstractions by a reduction in water quantity and availability. This could arise from dewatering of the trenched or trenchless excavations for the pipeline, HAGIs and BVI construction works intercepting the water table and/or ground disturbance for the development of temporary access track and/or temporary construction compound establishment reducing infiltration. There may also be a requirement to use water for dust suppression during construction activities in the summer months.

2.2.19 Effects may be greater at crossing locations where the depth of excavations are deeper and/or where shallower groundwater features are encountered (such as in valley floor locations around watercourses). In consultation with the Environment Agency, a screening exercise within **Appendix 7B** has been undertaken using a conceptual model to identify areas of shallow groundwater where groundwater flow has the potential to interact with the Project's pipeline subsurface infrastructure. All areas along the pipeline route have been scoped out of having major interaction with shallow groundwater except for the Frodsham area along the West Corridor. However, even here horizontal groundwater flow within the surface would be minimal due to low permeability sediments and shallow hydraulic gradients in the area where flow is largely controlled by surface drainage. It is recognised that buried channels in this area may influence groundwater flow and any impacts would be mitigated through GI and appropriate design.

2.2.20 An additional screening exercise also documented in **Appendix 7B** has been undertaken in the case where the Draft Order Limits is found to intersect SPZs and likely abstraction zones of influence (ZoIs), in order to aid the conceptual understanding of SPZ areas intersected by the works. Where HDD or micro-tunnelling and major construction is proposed within these SPZs, construction activities are sited outside of the inner SPZ1s and SPZ2s, reducing any potential impact on recharge in the area. Although no dewatering and radius of influence calculations for excavations have been undertaken at this time suitable measures would be employed (see **Chapter 7: Water Environment -Table 7.16**) and any dewatering impacts would be subject to appropriate permitting and licensing determined by the regulatory authority. The influence on groundwater levels due to the Project of less permeable access track or temporary construction compound establishment reducing infiltration would also be mitigated through design and embedded environmental measures developed during construction planning as part of the DWMP and CEMP.

2.2.21 With respect to the Medium Sensitivity WFD groundwater bodies, given the short period of time and scale of construction and the implementation of the proposed environmental measures most effects due to excavation dewatering are likely to be Negligible, whilst the influence on groundwater levels due to the development of less permeable access track or temporary construction compound establishment reducing infiltration are also likely to be Negligible. Therefore the significance of the effect on declines in groundwater levels within WFD groundwater bodies is likely to be **Negligible** (**Not Significant**) (**Table 7D.3**).

2.2.22 Some groundwater abstractions occur within 100m of the Draft Order Limits including the monitoring boreholes at the Solvay Interox Ltd, Warrington and Penketh, Cheshire and at Fiddlers Ferry Power Station, Widnes. These facilities are currently being decommissioned and although in close proximity the possibility of changes to groundwater levels and the hydrogeological regime within the vicinity of these abstraction boreholes, even where trenchless crossings are undertaken, are likely to be minimal with embedded measures in place.

2.2.23 In the same way, with the implementation of the proposed environmental measures the effect of dewatering and reduced infiltration on the associated High and Low Sensitivity abstractions (licensed public groundwater supplies and licensed non-public/deregulated groundwater abstractions respectively) is regarded as of Negligible magnitude respectively. Therefore, the effects are **Minor (Not Significant)** and **Negligible (Not Significant)** (**Table 7D.3**) respectively.

Table 7D.3 Summary of effects: Impacts on groundwater levels and/or hydrogeological flow regimes from the dewatering of trenched or trenchless excavations for pipeline and/or the effects of underground infrastructure due to barriers to flow and/or the development of less permeable access track or temporary construction compound establishment reducing infiltration

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
WFD Groundwater Bodies	Medium	*Wirral and West Cheshire Permo-Triassic Sandstone Aquifers* *Weaver and Dane Quaternary Sand and Gravel Aquifers* *Manchester and East Cheshire Permo-Triassic Sandstone Aquifers* *Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers* *Sankey and Glaze Carboniferous Aquifers*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-7**: Management of dewatering of excavations **C-10**: Timely reinstatement following completion of works **Construction - pollution prevention:** **C-19**: A monitoring and inspection programme **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings	Negligible	Negligible (**Not Significant**)
Licensed Public Groundwater Supplies	High	*Higher Walton* *Daresbury* *Eccleston Hill* *Bold Heath* *Broomedge*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-7**: Management of dewatering of excavations **C-10**: Timely reinstatement following completion of works **Construction - pollution prevention:** **C-19**: A monitoring and inspection programme **C-21**: Pre-commissioning pipeline testing **Construction - watercourse crossings:** **C-25**: WCP	Negligible	Minor **(Not Significant)**

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
Licensed Non-Public Groundwater Abstractions	Low	*(A1 Borehole at Peterhouse Farm, Gorsey Lane, Warburton)* *(A65 Well at Dairy Farm, High Legh, Knutsford)* *(A48 Well at Aston Grange, Preston Brook)* *(A4 to A7; A9 to A13; A25 to A33 and A51 to A56 Boreholes X 6 At Warrington and Penketh Cheshire - Wells 1,2, 5,6, 11 and 12)* *(A49 Borehole at Premises at Rocksavage Works, Runcorn)* *(A57 – A62 Borehole No 7 At Thornton-Le-Moors and Stanlow, Ellesmere Port)* *(A44 Borehole at Gatewarth Ind. Estate, Sankey Bridges, Warrington)* *(A8 AO Plant Wells, Solvay Interox Ltd.)* *(A34 – A43 5 Boreholes at Fiddlers Ferry Power Station, Widnes)* *(A45 Borehole near premises at Moorfield Road, Widnes)* *(A84 Borehole at Mersey Bank Farm, Hapsford, Helsby)*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-7**: Management of dewatering of excavations **C-10**: Timely reinstatement following completion of works **Construction - pollution prevention**: **C-19**: A monitoring and inspection programme **C-21**: Pre-commissioning pipeline testing **Construction - watercourse crossings:** **C-25**: WCP	Negligible	Negligible **(Not Significant)**

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		(A2, A3 Borehole at Broad Oak Farm, Warburton Lymm) *(A24 Borehole at Blackstone Farm, Lower Whitley, Daresbury)*			
Deregulated Abstractions	Low	*A165 Borehole at Mersey Bank Farm, Hapsford, Helsby* *(A170 Borehole at Peterhouse Farm, Gorsey Lane, Warburton)*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-7**: Management of dewatering of excavations **C-10**: Timely reinstatement following completion of works **Construction - pollution prevention:** **C-19**: A monitoring and inspection programme **C-21**: Pre-commissioning pipeline testing **Construction - watercourse crossings:** **C-25**: WCP	Negligible	Negligible **(Not Significant)**

Notes: * WFD surface water bodies that are proposed to have trenched watercourse crossings.

+ Licensed non-public groundwater abstraction and de-regulated abstraction receptors within brackets are inside or within 500m of the Draft Order Limits. All other receptors within the list are over 500m and less than 1.5km from the Draft Order Limits.

Reduction of water availability, due to impacts on groundwater levels or water quality, to support existing groundwater or surface water designated sites, ecosystems and water dependent features

2.2.24 A reduction of water availability to support existing groundwater or surface water designated sites, ecosystems and features could arise from dewatering of the trenched excavations for the pipeline, HAGIs and BVIs, ground disturbance for the development of temporary access track establishment, or the leakage or spillage of fuels and chemicals onsite. A decline in groundwater levels and/or surface flows associated with works and/or the pollution of these waters would have the potential to impact groundwater or surface water designated sites, ecosystems and water dependent features.

2.2.25 Effects may be greater at crossing locations where the depth of excavations are deeper, and/or where shallower groundwater features are encountered, such as in valley floor locations around watercourses. As discussed earlier, a screening exercise within **Appendix 7B** has been undertaken to identify areas of shallow groundwater where groundwater flow has the potential to interact with the Project's pipeline subsurface infrastructure.

2.2.26 Although no dewatering and radius of influence calculations for excavations have been undertaken at this time suitable environmental measures would be deployed (see **Chapter 7: Water Environment - Table 7.16**), and any dewatering impacts would be subject to appropriate permitting and licensing determined by the regulatory authority. The influence on groundwater levels due to the development of less permeable access track or temporary construction compound establishment reducing infiltration would also be mitigated through embedded environmental measures developed during construction planning as part of the DWMP and CEMP implemented post DCO. In the same way the range of measures proposed in **Chapter 7: Water Environment - Table 7.16** would also mitigate against accidental contamination.

2.2.27 Conservation site receptors range from High to Low Sensitivity based on their designation, with the Mersey Estuary being of High Sensitivity due to its Ramsar and SPA designation, Woolston Eyes and Pettypool Brook Valley being of Medium Sensitivity due to their SSSI designation and LWSs being of Low Sensitivity. Indeed, Pettypool Brook Valley is a wetland habitat located approximately 150m from the Draft Order Limits at its closest point. The proposed pipeline runs through an accumulation of peat to the north-east of the habitat and pathways surface and groundwater flows will need to be assessed and maintained in this area. The magnitude of any effects arising from impacts on quality and/or quantity of water supply to the conservation sites are likely to generally be Negligible, given the temporary nature of works, in many cases the distance of sites from the works (dilution effects), and the implementation of embedded measures. This results in **Negligible - Minor** (**Not Significant)** (**Table 7D.4**) effects.

2.2.28 The exception to this is where LWSs intercept or are close to the Draft Order Limits and works may directly interact with a conservation site or where

works are upstream of a conservation site. For example, the Lower Weaver Valley Woods LWS is adjacent to the Draft Order Limits and contains a pond and watercourse whose catchment is down hydraulic gradient of proposed works. Even so, given the implementation of environmental measures, the short period of time and scale of construction most effects are likely to only be of Negligible magnitude, and the effect remains **Negligible (Not Significant) (Table 7D.4)**.

Table 7D.4 Summary of effects: Reduction of water availability to support existing groundwater or surface water designated or undesignated sites, ecosystems and features

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
Conservation Sites	High	*C4 Mersey Estuary (Ramsar and SPA)*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works	Negligible	Minor (**Not Significant**)
Conservation Sites	Medium	*C2 Woolston Eyes (SSSI)* *C3 Pettypool Brook Valley (SSSI)*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
Conservation Sites	Low	*C7 Thatto Heath Meadows (LNR, LWS)* *C10 Marshall's Arm, Hartford (LNR)* *C14 Old mineral line Lea Green (LWS)* *C15 Pendlebury Brook (LWS)* *C16 Whittle Brook (LWS)* *C17 Ansdells Wood (LWS)* *C18 Ravenhead Ponds (LWS)* *C23 Sutton Manor (LWS)* *C24 Sinderland Green (LWS)* *C25 Partington Nature Reserve (LWS)* *C28 Moore Nature Reserve (LWS)* *C29 Moss Side Farm (LWS)* *C30 Norton Marsh and Upper Moss Side Fields (LWS)* *C31 Gatewarth (LWS)* *C33 Rows Wood (LWS)* *C34 St Helens Canal Disused A (LWS)*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		C36 Pitts Heath Wood (LWS) *C37 Clifton Lagoon (LWS)* *C38 Mort's Wood (LWS)* *C44 Disused Railway Line South of Warrington Road (LWS)* *C52 Weston Marsh Lagoon (LWS)* *C57 Clifton Cloughs_B (LWS)* *C58 Clifton Cloughs_A (LWS)* *C59 Walton Locks (LWS)* *C63 Woolstencroft Farm Meadow (LWS)* *C64 Fields Behind Ye Olde No. 3_B (LWS)* *C66 Frodsham Field Studies Centre (LWS)* *C67 Sutton Bridge Unused Lagoon (LWS)* *C68 Lowes Wood (LWS)* *C69 Lower Weaver Valley Woods (LWS)* *C75 East Clifton Tip (LWS)* *C79 Birds Wood (LWS)*		

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		C80 Rye Grass Pipes (LWS) *C81 Quick Woods (LWS)* *C83 Park Brow Pool (LWS)* *C85 Lodge Wood (LWS)* *C86 Garden Wood (LWS)* *C87 Dutton Dean (LWS)* *C88 New Pool and Wood (LWS)* *C91 Weaver Valley/ Newbridge Pool (LWS)* *C94 Heys Wood and the Riddings (LWS)* *C102 Dutton Dingles (LWS)* *C103 Acton Bridge Meadows (LWS)* *C110 Helsby Hill (LWS)* *C112 Sandiway Golf Course (LWS)* *C113 Frodsham, Helsby and Ince Marshes (LWS)* *C115 Puddinglake Brook Wood (LWS)* *C117 Trent and Mersey Canal, Whatcroft (LWS)* *C118 Whatcroft Lane Wetlands (LWS)*			

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		C119 Littledales Gorse (LWS) *C120 Meadow by Earls Wood and River Dane (LWS)* *C121 Park Moss Wood (LWS)* *C123 Merryfall Wood (LWS)* *C124 Cuddington Brook (North) (LWS)* *C127 River Dane, Bostock (LWS)* *C130 Sutton Mill Dam (LWS)* *C136 Sinderland Green Wood (LWS)* *C137 Red Brook (LWS)*			

Potential effects on hydromorphology and flow regime of surface water bodies as a result of increased runoff, dewatering of excavations and sediment inputs from working areas or direct watercourse disturbance (including from new watercourse crossings)

2.2.29 The entrainment of loose sediment exposed through excavation, e.g. during the installation of watercourse crossings and associated earthworks, could impact watercourse hydromorphological processes by altering bedforms within the watercourses through sediment deposition and subsequent changes in the cross-sectional profile. Changes in watercourse conveyance and flow dynamics could also be associated with temporary watercourse crossings. Such changes to the sediment dynamics could also potentially alter prevailing operating erosion and deposition processes. In addition, during works in the vicinity of watercourses there may be the temporary loss of riparian habitat that again affects watercourse hydromorphology. Potential receptors include all watercourses within close proximity to surface works associated with HAGIs, BVIs, new outfalls, discharges from dewatering of excavations, temporary compounds/crossings and trenchless pipeline watercourse crossings.

2.2.30 For Medium Sensitivity WFD surface water bodies and also Low Sensitivity Ordinary Watercourses, a range of measures are proposed in **Chapter 7: Water Environment - Table 7.16** that would mitigate against the mobilisation of sediments. The details of these measures would be developed during construction planning as part of the DWMP, WCP and CEMP (preparation of which would be secured via a DCO requirement).

2.2.31 As one of these measures, and as mentioned previously, turbidity monitoring would be undertaken by an ECoW during the construction stage where it is deemed to be required based on the sensitivity of local aquatic species receptors to watercourse morphology changes. The need and frequency of turbidity monitoring would be determined by the regulatory authority and detailed in any required permits for undertaking work within or near watercourses. Even where watercourses are located downstream of watercourse tributaries crossed by open cut methods, dispersion within downstream flows would reduce impacts. Embedded mitigation strategies adopted to avoid impacts on fisheries and other aquatic receptors due to watercourse morphology change are provided within **Chapter 5: Biodiversity**.

2.2.32 Open cut methodologies proposed at watercourse crossings on Main Rivers with a hydromorphology conservation values higher than 4 are of particular interest and sensitivity in terms of impacts upon watercourse aspects of habitat and riparian corridor loss. Mitigation strategies adopted to protect watercourses, minimise permanent or temporary land take/land use change (resulting in habitat loss or degradation) and habitat reinstatement are provided within **Chapter 5: Biodiversity**.

2.2.33 Changes to watercourse morphology during both trenchless and trenched watercourse crossings with the implementation of the embedded environmental measures are considered to have a Negligible magnitude of change and the effect is **Negligible** (**Not Significant**) (**Table 7D.5**).

2.2.34 Temporary access crossings are likely to be in place for a longer period (up to months in duration). Nevertheless, with the implementation of embedded measures the potential effect of these crossings on surface water body morphology and connection is assessed as having a Negligible magnitude of change, resulting in a **Negligible** (**Not Significant**) effect (**Table 7D.5**).

Table 7D.5 Summary of effects: Potential effects on hydromorphology and flow regime of surface water bodies as a result of increased runoff, dewatering of excavations and sediment inputs from working areas or direct watercourse disturbance (including from new watercourse crossings)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
WFD Surface Water Bodies	Medium	*Mersey* *Sinderland Brook** *Whittle Brook (Mersey Estuary)* *Sutton Brook** *Weaver (Dane to Frodsham)** *Mersey/Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin)* *River Weaver (Barnet to Valley Brook)* *River Weaver (Valley Brook to Winsford Flashes)* *River Weaver (Winsford Flashes to Dane)* *Bollin (Ashley Mill to Manchester Ship Canal)** *Dane (Wheelock to Weaver)* *Gale Brook** *Puddinglake Brook** *Bogart Brook* *Cuddington Brook* *Wade Brook*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-4**: Diversion and reinstatement of existing drainage networks **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-7**: Management of dewatering of excavations **C-8**: Silt management measures **C-9**: Stand-off distances from watercourses, flood defences and water supply/sewerage infrastructure **C-10**: Timely reinstatement following completion of works **C-11**: Permitting of discharges **C-12**: Discharge outfall design **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		Peckmill Brook, Hoolpool Gutter at Ince Marshes water body* *Arley Brook (Source to Gale Brook)** *Keckwick Brook* *Cogshall Brook** *Mersey (Bollin confluence to Howley Weir) including Padgate Brook* *Hardshaw (Windle) Brook* *Weaver Navigation (canal section Frodsham to Weston Point Docks)* *Bridgewater Canal* *Manchester Ship Canal* *Sankey Canal* *Trent and Mersey Canal, summit to Preston Brook Tunnel*			
Surface Water Bodies	Low	*Non-reportable WFD bodies* *Ordinary Watercourses* *Minor watercourses and ditches*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-7**: Management of dewatering of excavations **C-8**: Silt management measures	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
			C-10: Timely reinstatement following completion of works **C-12**: Discharge outfall design **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings		

Notes: *WFD surface water bodies that are proposed to have trenched watercourse crossings.

Physical disruption to existing discharge infrastructure from trenching and temporary access track or temporary construction compound establishment

2.2.35 The physical disruption to existing discharge infrastructure, e.g. septic tank soakaways or discharge outfalls, from trenching and temporary access track or temporary construction compound establishment can be prevented through embedded measures, particularly through micro-siting of construction activities and infrastructure.

2.2.36 The details of measures would be developed during construction planning as part of the DWMP, WCP and CEMP (preparation of which would be secured via a DCO requirement) and subject to any required permits for undertaking work within or near watercourses. During consultation with United Utilities it was recognised that their assets (including Combined Sewer Overflow (CSO) outfalls, pipe bridges, etc.) located within the Draft Order Limits may not have permits assigned to them and may not always be mapped. As such, during construction a watching brief should be established as part of the CEMP to protect these non-permitted and unmapped assets.

2.2.37 Only five discharge licences exist within the Draft Order Limits and these receptors are of a Low Sensitivity, being small-scale permitted discharges, e.g. local-scale and likely small WWTW treated effluent discharges, although discharge volume data were not supplied by the Environment Agency. With the implementation of the embedded environmental measures any effects on the discharge infrastructure are likely to be Negligible, and therefore the effects are **Negligible** (**Not Significant**) (**Table 7D.6**).

Table 7D.6 - Summary of effects: Physical disruption to existing discharge infrastructure from trenching and temporary access track or temporary construction compound establishment

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
Consented Discharges	Low	*D1 Porch House Farm, Runcorn Road, Higher Walton* *D2 East Clifton Marsh Northern Outfall* *D3/D4 Encirc, Ash Road, Elton, Cheshire* *D5 Weaver Sailing Club*	**Overall design:** **D-2:** Optimisation of routing **Construction - general:** **C-1**: CEMP **C-9:** Stand-off distances from watercourses, flood defences and water supply/sewerage infrastructure	Negligible	Negligible (**Not Significant**)

Reduction of water availability to support existing surface water abstractions or changes to flow regimes as a consequence of water quantity and/or quality effects arising from pre-commissioning pipeline testing

2.2.38 Following installation of the Project's hydrogen pipeline, pre-commissioning activities, including hydrostatic testing of the pipeline system, would determine the structural integrity of the pipeline. Hydrostatic testing involves filling the pipeline in sections with water which are then pressurised to test the line for leaks. The associated abstraction and discharge of water could potentially have effects on the water environment, both in terms of quantity and quality.

2.2.39 Specifications and philosophy around pipeline hydrostatic testing and pre-commissioning indicate that any abstraction is likely to be from larger surface water bodies. Constraints would also apply to surface water abstraction in accordance with environmental water abstraction good practice, notwithstanding any specific requirements of the regulating authority and terms of the water abstraction licence.

2.2.40 Detailed hydrostatic testing proposals have been consulted on with the Environment Agency and it was agreed that hydrostatic testing could be managed through the abstraction licence and environmental permitting process. In addition, the reuse of water would be maximised.

2.2.41 Exact volumes required for these activities are yet to be specified and after testing water quality discharges would need to be made back to the surface water environment. The discharges would be subject to abstraction licensing and discharge permits as required and consideration would be given to discharging at multiple locations to reduce impacts on receiving watercourses.

2.2.42 Any location selected for extraction must also be subject for approval by the regulating authority. There are a number of rivers and canals along the proposed pipeline route where water could potentially be abstracted, including the River Mersey, the River Weaver and Weaver Navigation Canal, Bridgewater Canal and the Manchester Ship Canal. These are water bodies of high volume and flow, but no more than 10% of water flow in the river/channel would be permitted for abstraction. Notwithstanding regulatory body requirements, the Project would also set its own good environmental practice on percentage volume limits and timing of abstraction, depending in part of fish spawning seasons and abstraction equipment requirements.

2.2.43 Where possible hydrotest water would be discharged back to its source. However, water quality would be tested prior to the hydrotest and also prior to discharge. If water treatment is necessary to bring the water to the desired quality for the hydrotesting programme then it would be proposed and agreed with the Environment Agency.

2.2.44 On the basis of the embedded environmental measures being implemented the effect of the pre-commissioning pipeline testing on the named Medium

Sensitivity WFD surface water bodies is considered to be of Negligible/Low magnitude and would constitute a **Negligible** (**Not Significant**) effect (**Table 7D.7**).

Table 7D.7 Summary of effects: Reduction of water availability to support existing surface water abstractions or changes to flow regimes as a consequence of water quantity and/or quality effects arising from pre-commissioning pipeline testing

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
WFD Surface Water Bodies	Medium	*Mersey* *Weaver (Dane to Frodsham)* *River Weaver (Winsford Flashes to Dane)* *Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin)* *Weaver Navigation Canal* *Bridgewater Canal* *Manchester Ship Canal*	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-5**: Private abstraction risk assessment and mitigation strategy **C-6**: Temporary provision of surface water drainage for construction areas **C-8**: Silt management measures **C-9**: Stand-off distances from watercourses, flood defences and water supply / sewerage infrastructure **C-10**: Timely reinstatement following completion of works **C-11**: Permitting of discharges **C-12**: Discharge outfall design **Construction - pollution prevention:** **C-13**: PPP **C-18**: Treatment and discharge of contaminated groundwater **C-19**: A monitoring and inspection programme**C-21**: Pre-commissioning pipeline testing	Negligible	Negligible (**Not Significant**)

Flood risk

2.2.45 Flood risk receptors include the elements of the construction activities associated with the Project as well as external (non-project) receptors in their vicinity. Receptors include people, property and infrastructure. Receptor sensitivity has been based on a receptor's vulnerability according to NPPF. **Chapter 7: Water Environment - Table 7.20** sets out the types of receptors and their sensitivity. The assessment of flood risk effects has been separated into a consideration of the Project and non-project receptors.

2.2.46 Project receptors are mostly classed as essential infrastructure and thus High Sensitivity (see **Appendix 7F, Table 7F3.1**). Where the pipeline must cross watercourses, its construction is classed as water compatible development and Very Low Sensitivity.

2.2.47 There is a high number of potential non-project receptors (see examples in **Chapter 7: Water Environment - Table 7.20**). Rather than assessing individual receptors, all potential receptors are assessed as a group with a varying Sensitivity of Low to High.

2.2.48 Construction activities have the potential to increase flood risk to receptors through interacting with flood mechanisms. Impacts could arise from loss of channel conveyance, volumetric displacement or interruption of conveyance of flood water in the floodplain or mobilisation of stored materials leading to impact or obstruction downstream.

2.2.49 Temporarily storing construction materials in areas at risk of flooding is one such example; the construction materials take up volume that was previously available to store flood waters, therefore raising the overall flood level. Pipe sections could be lifted and moved by the floodwater leading to damage to property or infrastructure. Materials could also be swept away and lead to blockages in watercourse crossings.

2.2.50 The loss of floodplain storage through construction of temporary stockpiles and infrastructure and raised access tracks within floodplain areas is mitigated through preferential siting, sequential design, and minimising raised structures in areas of floodplain. Where raised structures cannot be avoided, appropriate mitigation would be provided, such as aligning features with flow directions, leaving gaps and providing cross-drainage, timing of works to occur during the driest months of the year and to heed flood warnings, including maintaining a watching brief for areas benefitting from defences. Flood risks would also be managed through the preparation of a Flood Emergency Response Plan (FERP). Additionally, measures would be put in place to contain materials and keep them separated from flood waters at trenchless crossing compounds located in areas of flood risk. All of these measures have been identified as embedded measures (**Chapter 7: Water Environment -Table 7.16**) which include a CEMP and FRA and measures secured via DCO requirement.

2.2.51 As a result of this mitigation, effects on High Sensitivity project receptors are likely to be Negligible in magnitude and **Minor** (**Not Significant**) (**Table**

7D.8). Effects on Low to High sensitivity non-project receptors are expected to be Negligible in magnitude and **Negligible/Minor** (**Not Significant**) (**Table 7D.8**). However, there are two exceptions, as described below.

2.2.52 Approximately half of the material storage area of High Sensitivity at Acton Bridge coincides with Flood Zone 2 associated with the River Weaver and is in an area where flooding has been recorded in the past. The High Sensitivity material storage area at Eastford Road, associated with the Novelis Spur, is entirely in Flood Zone 3 adjacent to the River Mersey. In the event of a flood event on the River Weaver or the River Mersey respectively the magnitude of effect could be Medium, even with the embedded measures. In the worst case, this could lead to **Major** (**Significant**) (**Table 7D.8**) effects on project receptors and **Moderate (Potentially Significant)** to **Major (Significant)** effects on non-project receptors. The use/design of this material storage area is currently under review.

2.2.53 Only the northern corner of the Sutton Manor material storage area is located within Flood Zones 2 and 3. Through sequential planning of the site it is possible to avoid the areas of highest risk and with embedded mitigation reduce the magnitude of effect on Low to High Sensitivity non-project receptors to Negligible and **Negligible/Minor** (**Not Significant**) (**Table 7D.8**). The use/design of this material storage area is currently under review.

2.2.54 Potential increases in flood risk to non-project receptors of Very Low to Medium Sensitivity in predominantly rural areas may lead to loss of channel conveyance and increase in flood risk as a result of new temporary access road bridges. The embedded crossing design ensures impacts on channel conveyance and flood storage are minimised, such that the effects on non-project receptors are likely to be Negligible in magnitude and **Negligible** (**Not Significant**) (**Table 7D.8**).

2.2.55 Low magnitude changes to in-channel conveyance due to pipe laying at watercourse crossings (which themselves are classed as water compatible and as such Very Low Sensitivity) with a potential effect on Low-High sensitivity non-project receptors would be managed through design and through embedded environmental measures during construction. Crossings of major watercourses would be trenchless to avoid any disruption to the channel and conveyance capacity. Trenched open cut pipeline crossings of minor watercourses would be temporary and localised. The crossing technique would include mitigation through the isolation of the watercourse at the crossing location with fluming or over pumping during pipeline installation and re-instatement to existing capacity following completion of works. Therefore, effects on the pipe laying itself as well as on non-project receptors are Negligible in magnitude and **Negligible** (**Not Significant**) (**Table 7D.8**).

2.2.56 Overall, with the exception of the Acton Bridge and Eastford Road material storage areas that have the potential to cause a **Moderate (Potentially Significant)** to **Major (Significant)** effect, the significance of effect to flood risk receptors is **Negligible** to **Minor** (**Not Significant**) (**Table 7D.8**).

Table 7D.8 Summary of effects: Flood risk during construction

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
Flood risk **See paragraph 2.2.51**	High	Project receptor: All construction activities and elements (except pipeline watercourse crossings), namely pipe laying, material storage areas, trenchless crossing compounds, HAGI temporary compounds, temporary access routes. Flood risk is from existing sources and would be exacerbated through construction activities that lead to loss of channel conveyance, volumetric	**Overall design:** **D-2**: Optimisation of routing **D-3:** Development of flood protection and drainage measures **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction – water and silt management:** **C-2**: DWMP **C-3**: Timing of works **C-8**: Silt management measures to contain excavated materials, soil from soil processing plants, materials from settlement pits, mud/ slurry from drilling, other stored materials and equipment, and fuel **C-9:** Stand-off distances from watercourses, flood defences and water supply and sewage infrastructure **C-10**: Timely reinstatement **Construction - pollution prevention:** **C-13**: PPP designed to protect to design flood level plus suitable freeboard	Negligible	Minor (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		displacement of flood water in the floodplain through stock piling and raised infrastructure, or mobilisation of stored materials leading to impact or obstruction downstream.	**C-14**: Storage of hydrocarbons and other chemicals in a way that keeps them separated from flood waters **C-19**: Monitoring and inspection programme **Construction – flood risk:** **C-22:** Preferential siting **C-23**: FERP **C-24:** Minimise raised structures in floodplains **C-28:** Temporary construction access watercourse crossings		
See paragraph 2.2.51	Low - High	Non-project receptors. Flood risk is from existing sources and would be exacerbated through construction activities that lead to loss of channel conveyance, volumetric displacement of flood water in the floodplain through stock piling and raised infrastructure,	**Overall design:** **D-2**: Optimisation of routing **D-3:** Development of flood protection and drainage measures **D-4:** Temporary access tracks design **Construction - general:** **C-1**: CEMP **Construction – water and silt management:** **C-2**: DWMP **C-3**: Timing of works **C-8**: Silt management measures to contain excavated materials, soil from soil processing plants, materials from settlement pits, mud/ slurry from drilling, other stored materials and equipment, and fuel	Negligible	Negligible (**Not Significant**) to Minor (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		mobilisation of stored materials leading to impact or obstruction downstream, changes to surface water flow routes through earthworks and changes to infiltration through introduction of temporary hard standing areas.	**C-9:** Stand-off distances from watercourses, flood defences and water supply and sewage infrastructure **C-10**: Timely reinstatement **Construction - pollution prevention:** **C-13**: PPP designed to protect to design flood level plus suitable freeboard **C-14**: Storage of hydrocarbons and other chemicals in a way that keeps them separated from flood waters **C-19**: Monitoring and inspection programme **Construction – flood risk:** **C-22:** Preferential siting **C-23**: FERP **C-24:** Minimise raised structures in floodplains **C-28:** Temporary construction access watercourse crossings		
See paragraph 2.2.52	High	Project receptor: Material storage areas at Acton Bridge and at Eastford Road (Novelis Spur)	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP/Drainage strategies **C-3**: Timing of works **C-6**: Temporary provision of surface water drainage for construction areas	Medium	Major (**Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
			Construction – flood risk: **C-22:** Preferential siting **C-24:** Minimise raised structures in floodplains		
See paragraph 2.2.52	Low - High	Non-project receptor: Third party receptors near material storage areas at Acton Bridge and at Eastford Road (Novelis Spur)	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP/Drainage strategies **C-3**: Timing of works **C-6**: Temporary provision of surface water drainage for construction areas **Construction – flood risk:** **C-22:** Preferential siting **C-24:** Minimise raised structures in floodplains	Medium	Moderate (**Potentially Significant**) to Major (**Significant**)
See paragraph 2.2.53	Low - High	Non-project receptor: Third party receptors near material storage area at Sutton Manor	**Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP/Drainage strategies **C-3**: Timing of works	Negligible	Negligible (**Not Significant**) to Minor (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		Increased flood risk through mobilisation of stored materials in the flood zone and causing medium magnitude impact downstream, and increased flood risk through loss of floodplain storage through stored materials in the flood zone.	**C-6**: Temporary provision of surface water drainage for construction areas **Construction – flood risk:** **C-22:** Preferential siting **C-24:** Minimise raised structures in floodplains		
See paragraph 2.2.54	Very Low - Medium	Non-project receptor: Third party receptors near temporary access road bridges	**Overall design:** **D-4:** Temporary access tracks design **Construction – flood risk:** **C-25:** WCP incorporated into CEMP **C-28:** Temporary construction access watercourse crossings	Negligible	Negligible (**Not Significant**)
See paragraph 2.2.55	Very Low	Project receptor: Pipe laying at watercourse crossings	**Construction – flood risk:** **C-25:** WCP incorporated into CEMP **C-26**: Trenchless pipeline crossings	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
			C-27: Trenched crossings of minor watercourses (timing of in-channel open cut crossings to avoid wettest time of year or when a flood warning is predicted)		
See paragraph 2.2.55	Low - High	Non-project receptor: Third party receptors near pipeline watercourse crossings	**Construction – flood risk:** **C-25:** WCP incorporated into CEMP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses (timing of in-channel open cut crossings to avoid wettest time of year or when a flood warning is predicted)	Negligible	Negligible (**Not Significant**) to Minor (**Not Significant**)

3. Operational Phase

3.1 Overview

3.1.1 During the operational phase of the Project, all pipelines would be underground and the only significant surface infrastructure would be at HAGIs and BVIs. Working areas would be restored, including removal of temporary construction access and reinstatement of existing agricultural drainage networks, once construction is completed.

3.1.2 Requirements for inspection, maintenance and refurbishment during the operational phase of the Project are expected to be limited, as discussed in **Chapter 2: The Project - Section 2.6**. The pipelines would be installed with corrosion protection and it is considered that their operation would largely be maintenance-free, although regular internal and external inspection would be undertaken. Internal inspection would be carried out via 'pigging' from HAGIs, whereas routine external inspections would be typically undertaken remotely, without the need for access across private land. Infrequent pipeline walkover surveys (every 2-7 years) would be carried out on foot.

3.1.3 The HAGIs and BVIs would not be permanently staffed and would typically be monitored remotely using CCTV. Inspection and minor servicing may be required for the electrical plant, but it is anticipated that the HAGIs and BVIs would require minimal scheduled operation and maintenance activities.

3.1.4 Given the minimal nature of the maintenance works, it is anticipated that the only water environment effects arising from the operational phase of the Project would be associated with the presence of the infrastructure. The pipelines have the potential to affect groundwater levels and subsurface flow pathways in their vicinity. Channel morphology and fluvial geomorphological processes could be affected at pipeline watercourse crossings should the pipelines become exposed. The limited above-ground infrastructure also has the potential to affect surface runoff and infiltration rates, which could affect groundwater recharge and surface water flood risk to external receptors. Depending on location, the above-ground infrastructure could, itself, be at risk of flooding from external sources. As noted in **Chapter 7: Water Environment - Table 7.19** flow regime effects on surface water bodies and all water quality effects due to discharges are scoped out of the assessment for the operational phase.

3.2 Assessment of the Potentially Adverse Effects on the Water Environment from Operational Activities

3.2.1 The assessment of water environment effects from operational activities is given within the following sections.

Changes in channel morphology and fluvial geomorphological processes should pipelines become exposed at watercourse crossings

3.2.2 An objective of pipeline design is to ensure that pipelines are located at sufficient depth below the bed of watercourses to ensure they do not become exposed over the lifetime of the development. This would be the case for all of the major trenchless crossings, given that crossings would be at significant depth below channel bed level (for instance, expected to be around 15m depth for HDD), and in these instances the possibility of operational phase morphological effects can be ruled out. Open cut crossings would be shallower but given that these would be crossings of smaller watercourses, and that most of those intersecting the Draft Order Limits are low-lying with low-gradient and/or low-energy watercourses, the risk of pipeline exposure in these watercourses is considered to be limited.

3.2.3 Nevertheless, these risks would be considered on a case-by-case basis during preparation of the WCP, which would be prepared to support the CEMP during the detailed design stage of the Project (**Chapter 7: Water Environment** – **Table 7.16**). Therefore, embedded measures include the initial routing and design of crossing as well as operational pipeline surveillance.

3.2.4 Based on data collected on baseline geomorphological processes and features of the crossed watercourses it is assessed that exposure over the Project's lifetime is not anticipated. Consequently, changes to watercourse morphology and geomorphological processes due to pipeline exposure and/or the need to retrofit erosion protection around pipeline crossings during the operational phase with the implementation of embedded measures are considered to be Negligible in magnitude and **Negligible** (**Not Significant**) (**Table 7D.1**).

Table 7D.1 Summary of effects: Changes in channel morphology and fluvial geomorphological processes should pipelines become exposed at watercourse crossings

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
WFD Surface Water Bodies	Medium	*Mersey* *Sinderland Brook** *Whittle Brook (Mersey Estuary)* *Sutton Brook** *Weaver (Dane to Frodsham)** *Mersey/Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin)* *River Weaver (Barnet to Valley Brook)* *River Weaver (Valley Brook to Winsford Flashes)* *River Weaver (Winsford Flashes to Dane)* *Bollin (Ashley Mill to Manchester Ship Canal)** *Dane (Wheelock to Weaver)* *Gale Brook** *Puddinglake Brook** *Bogart Brook* *Cuddington Brook* *Wade Brook*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-7**: Management of dewatering of excavations **C-8**: Silt management measures **C-10**: Timely reinstatement following completion of works **C-12**: Discharge outfall design **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
		Peckmill Brook, Hoolpool Gutter at Ince Marshes water body* *Arley Brook (Source to Gale Brook)** *Keckwick Brook* *Cogshall Brook** *Mersey (Bollin confluence to Howley Weir) including Padgate Brook* *Hardshaw (Windle) Brook* *Weaver Navigation (canal section Frodsham to Weston Point Docks)* *Bridgewater Canal* *Manchester Ship Canal* *Sankey Canal* *Trent and Mersey Canal, summit to Preston Brook Tunnel*			
Surface Water Bodies	Low	*Non-reportable WFD bodies* *Ordinary Watercourses* *Minor watercourses and ditches*	**Overall design:** **D-1:** Underground pipeline **D-2:** Optimisation of routing **Construction - general:** **C-1**: CEMP **Construction - water and silt management**: **C-2**: DWMP **C-3**: Timing of works **C-7**: Management of dewatering of excavations **C-8**: Silt management measures	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
			C-10: Timely reinstatement following completion of works **C-12**: Discharge outfall design **Construction - watercourse crossings:** **C-25**: WCP **C-26**: Trenchless pipeline crossings **C-27**: Trenched crossings of minor watercourses **C-28**: Temporary construction access watercourse crossings		

Notes: *WFD surface water bodies that are proposed to have trenched watercourse crossings.

Changes in shallow groundwater flow and level regime due to presence of surface and underground infrastructure

3.2.5 Any change in groundwater levels arising from subsurface obstructions to groundwater flow, i.e. pipeline and/or HAGI sub-surface foundations, are likely to be limited given the relatively shallow depth of most excavations compared to the deeper WFD groundwater bodies. In addition, above-ground infrastructure has the potential to affect surface runoff and infiltration rates, which could affect groundwater recharge.

3.2.6 Measures would be taken during construction to prevent the development of preferential subsurface pathways including the management of subsurface flow pathways and drainage design and permitting to minimise impermeable surfaces.

3.2.7 The current status of WFD groundwater bodies is 'Poor', giving a Medium Sensitivity for these receptors. Effects are expected to be greater within shallow groundwater bodies but, given the scale of the obstructions and on the basis of implemented embedded measures, most effects are likely to be of Negligible magnitude and there would be a **Negligible (Not Significant)** (**Table 7D.10**) effect.

3.2.8 Water resource receptors, such as licensed public and licensed non-public/deregulated abstractions usually utilise groundwater from depth and any impacts would be from reduced recharge. However, the effect of reduced infiltration on these High and Low Sensitivity abstractions respectively is regarded as of Negligible magnitude in all cases and therefore the effect is **Negligible - Minor (Not Significant)** (**Table 7D.2**).

3.2.9 Conservation site receptors range from High to Low sensitivity based on their designation, with the Mersey Estuary being of High sensitivity due to its Ramsar and SPA designation, Woolston Eyes and Pettypool Brook Valley being of Medium sensitivity due to their SSSI designation and LWSs being of Low sensitivity. The magnitude of any effects arising from impacts on quality and/or quantity of water supply to the conservation sites are likely to be Negligible, given the minimal changes to groundwater levels and recharge anticipated, in many cases the distance of any infrastructure from sites, and the implementation of embedded measures. As such, during the operational phase impacts are considered to be Negligible in magnitude and the effect is **Negligible - Minor (Not Significant)** (**Table 7D.2**).

Table 7D.2 Summary of effects: Changes in shallow groundwater flow and level regime due to presence of surface and underground infrastructure

Receptor groups	Sensitivity	Receptor[+]	Embedded environmental measures	Magnitude of effect	Significance of effect
Groundwater WFD Water Bodies	Medium	*Wirral and West Cheshire Permo-Triassic Sandstone Aquifers* *Weaver and Dane Quaternary Sand and Gravel Aquifers* *Manchester and East Cheshire Permo-Triassic Sandstone Aquifers* *Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers* *Sankey and Glaze Carboniferous Aquifers*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-10**: Timely reinstatement following completion of works	Negligible	Negligible (**Not Significant**)
Licensed Public Groundwater Supplies	High	*Higher Walton* *Daresbury* *Eccleston Hill* *Bold Heath* *Broomedge*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-10**: Timely reinstatement following completion of works	Negligible	Minor **(Not Significant)**
Licensed Non-Public Groundwater Abstractions	Low	*(A1 Borehole at Peterhouse Farm, Gorsey Lane, Warburton)* *(A65 Well at Dairy Farm, High Legh, Knutsford)* *(A48 Well at Aston Grange, Preston Brook)* *(A4 to A7; A9 to A13; A25 to A33 and A51 to A56Boreholes*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-10**: Timely reinstatement following completion of works	Negligible	Negligible **(Not Significant)**

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		X 6 At Warrington and Penketh Cheshire - Wells 1,2, 5,6, 11 and 12) *(A49 Borehole at Premises at Rocksavage Works, Runcorn)* *(A57 – A62 Borehole No 7 At Thornton-Le-Moors and Stanlow, Ellesmere Port)* *(A44 Borehole at Gatewarth Ind. Estate, Sankey Bridges, Warrington)* *(A8 AO Plant Wells, Solvay Interox Ltd.)* *(A34 – A43 5 Boreholes at Fiddlers Ferry Power Station, Widnes)* *(A45 Borehole near premises at Moorfield Road, Widnes)* *(A84 Borehole at Mersey Bank Farm, Hapsford, Helsby)* *(A2, A3 Borehole at Broad Oak Farm, Warburton Lymm)* *(A24 Borehole at Blackstone Farm, Lower Whitley, Daresbury)*			
Deregulated Abstractions	Low	*A165 Borehole at Mersey Bank Farm, Hapsford, Helsby* *(A170 Borehole at Peterhouse Farm, Gorsey Lane, Warburton)*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:**	Negligible	Negligible **(Not Significant)**

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
			C-2: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-10**: Timely reinstatement following completion of works		
Conservation Sites	High	*C4 Mersey Estuary (Ramsar and SPA)*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-10**: Timely reinstatement following completion of works	Negligible	Minor (**Not Significant**)
Conservation Sites	Medium	*C2 Woolston Eyes (SSSI)* *C3 Pettypool Brook Valley (SSSI)*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy **C-10**: Timely reinstatement following completion of works	Negligible	Negligible (**Not Significant**)
Conservation Sites	Low	*C7 Thatto Heath Meadows (LNR, LWS)* *C10 Marshall's Arm, Hartford (LNR)* *C14 Old mineral line Lea Green (LWS)*	**Overall design:** **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathway **Construction - general:** **C-1**: CEMP **Construction - water and silt management:** **C-2**: DWMP **C-5**: Private abstraction risk assessment and mitigation strategy	Negligible	Negligible (**Not Significant**)

Receptor groups	Sensitivity	Receptor[+]	Embedded environmental measures	Magnitude of effect	Significance of effect
		C15 Pendlebury Brook (LWS) *C16 Whittle Brook (LWS)* *C17 Ansdells Wood (LWS)* *C18 Ravenhead Ponds (LWS)* *C23 Sutton Manor (LWS)* *C24 Sinderland Green (LWS)* *C25 Partington Nature Reserve (LWS)* *C28 Moore Nature Reserve (LWS)* *C29 Moss Side Farm (LWS)* *C30 Norton Marsh and Upper Moss Side Fields (LWS)* *C31 Gatewarth (LWS)* *C33 Rows Wood (LWS)* *C34 St Helens Canal Disused A (LWS)* *C36 Pitts Heath Wood (LWS)* *C37 Clifton Lagoon (LWS)* *C38 Mort's Wood (LWS)* *C44 Disused Railway Line South of Warrington Road (LWS)*	**C-10**: Timely reinstatement following completion of works		

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		C52 Weston Marsh Lagoon (LWS) *C57 Clifton Cloughs_B (LWS)* *C58 Clifton Cloughs_A (LWS)* *C59 Walton Locks (LWS)* *C63 Woolstencroft Farm Meadow (LWS)* *C64 Fields Behind Ye Olde No. 3_B (LWS)* *C66 Frodsham Field Studies Centre (LWS)* *C67 Sutton Bridge Unused Lagoon (LWS)* *C68 Lowes Wood (LWS)* *C69 Lower Weaver Valley Woods (LWS)* *C75 East Clifton Tip (LWS)* *C79 Birds Wood (LWS)* *C80 Rye Grass Pipes (LWS)* *C81 Quick Woods (LWS)* *C83 Park Brow Pool (LWS)* *C85 Lodge Wood (LWS)* *C86 Garden Wood (LWS)* *C87 Dutton Dean (LWS)*			

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		C88 New Pool and Wood (LWS) *C91 Weaver Valley/ Newbridge Pool (LWS)* *C94 Heys Wood and the Riddings (LWS)* *C102 Dutton Dingles (LWS)* *C103 Acton Bridge Meadows (LWS)* *C110 Helsby Hill (LWS)* *C112 Sandiway Golf Course (LWS)* *C113 Frodsham, Helsby and Ince Marshes (LWS)* *C115 Puddinglake Brook Wood (LWS)* *C117 Trent and Mersey Canal, Whatcroft (LWS)* *C118 Whatcroft Lane Wetlands (LWS)* *C119 Littledales Gorse (LWS)* *C120 Meadow by Earls Wood and River Dane (LWS)* *C121 Park Moss Wood (LWS)* *C123 Merryfall Wood (LWS)* *C124 Cuddington Brook (North) (LWS)*			

Receptor groups	Sensitivity	Receptor+	Embedded environmental measures	Magnitude of effect	Significance of effect
		C127 River Dane, Bostock (LWS) *C130 Sutton Mill Dam (LWS)* *C136 Sinderland Green Wood (LWS)* *C137 Red Brook (LWS)*			

Notes: * WFD surface water bodies that are proposed to have trenched watercourse crossings.

+ Licensed non-public groundwater abstraction and de-regulated abstraction receptors within brackets are inside or within 500m of the Draft Order Limits. All other receptors within the list are over 500m and less than 1.5km from the Draft Order Limits.

Flood risk

3.2.10 Flood risk receptors include the elements of the permanent above-ground infrastructure associated with the Project (principally HAGIs and Block Valves) and the staff periodically maintaining them, as well as external (non-project) receptors in their vicinity. As for the construction phase, receptor sensitivity has been based on a receptor's vulnerability according to NPPF. **Chapter 7: Water Environment - Table 7.20** sets out the types of receptors and their sensitivity. The assessment of flood risk effects has been separated into a consideration of project and non-project receptors.

3.2.11 All permanent project infrastructure is classed as essential infrastructure and thus High Sensitivity (see **Appendix 7F, Table 7F3.1**).

3.2.12 There is a high number of potential non-project receptors (see examples in **Chapter 7: Water Environment - Table 7.20**). Rather than assessing individual receptors, all potential receptors are assessed as a group with a varying Sensitivity of Low to High.

3.2.13 The pipeline is classed as essential infrastructure and thus of High sensitivity, but given that it would be buried the magnitude of any effect to and from it would be Negligible, such that the residual effect to both project and non-project receptors is **Minor (Not Significant)** (**Table 3D.3)**.

3.2.14 Theoretically, the pipeline has the potential to disrupt shallow subsurface flows in areas where the groundwater table is close to the surface. However, all areas along the pipeline route were scoped out of having major interaction with shallow groundwater, except for the Ince and Frodsham Marshes area along the West Corridor. **Appendix 7F - Section 6.2** explains why the risk to Low to High Sensitivity non-project receptors here is of Negligible magnitude, resulting in a **Negligible/Minor (Not Significant)** effect **(Table 3D.3)**.

3.2.15 It is however recognised that buried channels in the Ince and Frodsham Marshes area may influence groundwater flow and change in flood patterns in turn. Any impacts would be mitigated through ground investigation and appropriate design, such as preferential siting, appropriate alignment, cross drainage and the appropriate placing of clay water barriers/mitigation as appropriate. With these embedded measures in place effects on receptors are of Negligible magnitude and **Negligible/Minor (Not Significant) (Table 3D.3)**.

3.2.16 During operation, High Sensitivity HAGI, BVIs, Distribution Network Operator (DNO) connections and pigging areas theoretically are at risk of flooding from various sources. Inundation of this infrastructure could disrupt maintenance activities and, in severe cases, compromise their integrity. The risk of flooding to these elements has already been mitigated through the selection of the most appropriate options and would be mitigated further through preferential siting

within the draft Limits of Deviation (LoD). Flood risks would also be managed through the preparation of an operational FERP, where appropriate.

3.2.17 As noted in **Appendix 7F**, detailed assessments were undertaken at four HAGI locations that would potentially be affected by fluvial or tidal flooding (Higher Walton, Rocksavage, HPP and HSF). The assessments conclude that none of the sites are at risk from the 0.5% AEP design event with higher central climate change allowance. The only exception is the far north-east corner of the Rocksavage DNO connection, which is at risk of fluvial flooding. As only a small part of the site is affected, preferential siting within the LoD would mitigate. With these measures in place, any operational phase tidal or fluvial flood risk effects on project infrastructure (HAGIs and BVIs) are Negligible in magnitude and **Minor (Not Significant) (Table 3D.3)**.

3.2.18 Placement of the HAGIs, BVIs, DNO connections and pigging areas into areas at risk of flooding from fluvial or tidal sources has the potential to increase risk of these sources to Low to High Sensitivity non-project receptors. Preferential siting of these elements outside of areas at risk also eliminates the risk to non-project receptors. The effect can be considered Negligible in magnitude and **Negligible/Minor (Not Significant) (Table 3D.3)**.

3.2.19 An alternative location is being considered for the Higher Walton HAGI, the HWH8 option. This option is at risk of fluvial and/or tidal flooding. From a flood risk perspective, the original Higher Walton site (HWH2) is preferable. However, a full modelling study investigating the risk to the HWH8 site is planned and will be assessed at the final ES stage.

3.2.20 Landform changes and new impermeable surfaces at HAGIs, BVIs, DNO connections and pigging areas could increase surface runoff rates and overland flow pathways, which could increase flood risk to Low to High Sensitivity external receptors in their vicinity. The risks of surface water flooding would be mitigated through the implementation of appropriate drainage systems including SuDS. Drainage Strategies (**Appendix F: Annex 7F6 Outline Drainage Strategy**) have been produced for all HAGI and BVI locations as part of the FRA to demonstrate how these would be implemented. Nevertheless, with SuDS and drainage strategy measures in place, any effect on receptors due to the increase in surface water run-off are likely to be Negligible in magnitude and **Negligible/Minor (Not Significant)** (**Table 3D.3**).

Table 3D.3 Summary of effects: Flood risk during the operational phase

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
Flood risk **See paragraph 3.2.13**	High	Project receptor: Pipeline	N/A	Negligible	Minor **(Not Significant)**
See paragraph 3.2.14	Low - High	Non-project receptors Increase of flood risk from buried pipeline disrupting shallow subsurface flows.	N/A	Negligible	Negligible (**Not Significant**) to Minor (**Not Significant**)
See paragraph 3.2.15	Low - High	Non-project receptors Influence to groundwater flow and in turn changed flood patterns from pipeline disrupting buried channels in the Ince and Frodsham Marshes area.	**Overall design:** **D-1:** Underground pipeline **D-2**: Optimisation of routing **D-5:** Management of subsurface flow pathways	Negligible	Negligible (**Not Significant**) to Minor (**Not Significant**)
See paragraph 3.2.17	High	Project receptor: HAGIs, Block Valves, DNO connections, pigging areas and maintenance staff	**Overall design:** **D-2**: Optimisation of routing **D-3**: Development of flood protection and drainage measures **Operational phase:** **O-1**: Periodic inspection and maintenance of flood protection and drainage measures	Negligible	Minor **(Not Significant)**
See paragraph 3.2.18	Low - High	Non-project receptors Increase of fluvial/tidal flood risk through placement of HAGIs, Block Valves, DNO connections and pigging areas in areas at risk of flooding.	**Overall design:** **D-2**: Optimisation of routing **D-3**: Development of flood protection and drainage measures **Operational phase:** **O-1**: Periodic inspection and maintenance of flood protection and drainage measures	Negligible	Negligible (**Not Significant**) to Minor (**Not Significant**)

Receptor groups	Sensitivity	Receptor	Embedded environmental measures	Magnitude of effect	Significance of effect
See paragraph 3.2.20	Low - High	Non-project receptors Increase of flood risk from surface water through landform changes and new impermeable surfaces at HAGIs, Block Valves, DNO connections and pigging areas.	**Overall design:** **D-2**: Optimisation of routing **D-3**: Development of flood protection and drainage measures **Operational phase:** **O-1**: Periodic inspection and maintenance of flood protection and drainage measures	Negligible	Negligible (**Not Significant**) to Minor **(Not Significant)**

4. Decommissioning Phase

4.1.1 The design life of the pipeline and HAGIs is anticipated as 40 years. It is reasonably expected that a statutory framework would be developed and agreed prior to any decommissioning. Similarly, future technology and good practice would develop and provide for new ways to undertake the process. A Decommissioning Plan would be developed by the Applicant in accordance with the strategy outlined within **Chapter 2: The Project**.

4.1.2 Proposals for decommissioning of the Project at the end of its operating life are described in **Chapter 2: The Project - Section 2.7**. In summary, it is likely that the buried pipeline would be left in-situ to avoid any environment effects associated with its removal, but that sections at crossings (including of watercourses) would be grouted. At HAGIs and BVIs, all above-ground infrastructure would be removed, residual subsurface pipework would be capped and backfilled and the surface restored or prepared for redevelopment.

4.1.3 As a consequence, decommissioning effects are likely similar to construction effects, but of a lesser magnitude and spatial extent, given that much of the subsurface infrastructure would be left in-situ. On the basis that the assessment presented in **Chapter 7: Water Environment - Section 7.9** concluded that most construction effects can be satisfactorily mitigated on the basis of the proposed embedded measures, it is anticipated that the same conclusions can be drawn for decommissioning phase effects, and these effects are therefore not referenced in a further set of tables. However, these effects would need to be subject to full assessment at the appropriate time, when detailed decommissioning proposals are put forward and in the context of the environment baseline and regulatory context prevailing at that time.

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