

## ENVIRONMENTAL STATEMENT (VOLUME III)

### Appendix 18.1 Baseline Information

HyNet North West Carbon Dioxide Pipeline DCO

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 –  
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# 1. APPENDIX 18.1 BASELINE

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## 1.1. INTRODUCTION

- 1.1.1. This appendix presents the baseline information for surface water bodies within the Study Area of the Water Resources and Flood Risk Assessment for the DCO Proposed Development. The full assessment is contained in **Chapter 18 – Water Resources and Flood Risk (Volume II)**.
- 1.1.2. The baseline information is presented as Main Rivers, Ordinary Watercourses and Canals. The watercourses are listed in each section in order from East to West along the DCO Proposed Development. Please refer to **Figure 18-1 - Watercourses (Volume IV)** for the locations of these watercourses and the location of the Study Area.
- 1.1.3. More detailed baseline information for Water Framework Directive quality elements for screened in water bodies is provided in **Annex C of Appendix 18.3 - Water Framework Directive Assessment (Volume III)**.
- 1.1.4. More detailed baseline information for flood risk is reported in **Appendix 18.4 – Flood Risk Assessment** and **Appendix 18.5 - Flood Consequences Assessment (Volume III)**.

## 2. MAIN RIVERS

### 2.1. EAST CENTRAL DRAIN



<b>Catchment area</b>	1.02km <sup>2</sup>
<b>Key hydraulic connections</b>	Flows into West Central Drain
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	The catchment mostly comprises grassland with some arable and horticultural land uses. A smaller proportion of built-up land cover and woodland. The catchment has an elevation between -4.9 - 40 mAOD).
<b>Study reach description</b>	The watercourse is a trapezoidal artificial channel which is incised and not connected with the floodplain. Water depth is between 0.5 – 0.8m whilst bankfull width is 5- 6.5m.  Bed material is silt and organic matter.

	<p>The riparian zone on the left bank is grazed, whilst the right bank is woodland. In-channel vegetation is limited.</p> <p>The East Central Drain has provided drainage for the Ince Marshes since at least 1885. The East Central Drain has maintained a similar planform since 1885, to present day.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Ince AGI is located within 8m of this watercourse and the surface water drainage system from this AGI will connect to this watercourse.</p>

## 2.2. WEST CENTRAL DRAIN



<b>Catchment area</b>	0.55km <sup>2</sup>
<b>Key hydraulic connections</b>	Drains the Elton Marsh Drains (1-13), joined by Hapsford Brook and East Central Drain at Ince Marshes. Flows northwards towards the Manchester Ship Canal where water is pumped into the canal at high flows. The watercourse discharges to Hoolpool Gutter.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	The West Central Drain forms the main stem off the Elton Marsh Drains (1 –13). The channel drains a small catchment of farm and agricultural land.
<b>Study reach description</b>	The watercourse is a trapezoidal artificial channel with bankfull width varying between 5-6m and water depth approximately 0.8m. It has a



	<p>mixture of steep and shallow banks through the Newbuild Infrastructure Boundary.</p> <p>Bed material is predominantly silt and organic matter. The riparian zone comprises grazed grassland which is frequently wet. There are tall grasses along both banks of the watercourses.</p> <p>The West Central Drain has provided drainage for the Ince Marshes since at least 1885. The Western Central Drain has maintained a similar form since 1914.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>West Central Drain will be crossed by the Newbuild Carbon Dioxide Pipeline in one location via open cut. The watercourse would also be crossed by vehicles using existing access tracks over existing culverts in the Newbuild Infrastructure Boundary.</p>

## 2.3. HAPSFORD BROOK



<b>Catchment area</b>	2.87km <sup>2</sup>
<b>Key hydraulic connections</b>	The Hapsford Brook drains the Elton Marshes between Hapsford Lane and the M56, connecting to Elton Marsh Drains 9 to 13 in peak flow and discharging to West Central Drain.
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	The channel drains a catchment consisting of arable and horticultural grasslands, with some areas of development (Hapsford and Elton). The source of the Hapsford Brook rises from Dunham-on-the-Hill (40.1 -60 mAOD).
<b>Study reach description</b>	The watercourse is a trapezoidal cut channel with a bankfull channel width of 5.5 m and depth of 0.4 m. The watercourse is ungauged.

	<p>With regards to bed material, there is extensive silt cover with some accumulations of organic matter. There is some emergent reeds and linear leaved aquatic vegetation.</p> <p>There is a low diversity of riparian vegetation, with the banks being largely bare. The riparian zone is grazed pasture which is frequently wet.</p> <p>The planform morphology of the channel has been unchanged since 1903, though the watercourse was culverted following the construction of the M56 roadway (1968-1971).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.4. GALE BROOK



<b>Catchment area</b>	6.64km <sup>2</sup>
<b>Key hydraulic connections</b>	The Gale Brook drains into the River Gowy. The channel is disconnected from its floodplain as it is incised and flows through a network of culverts.
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	<p>The Gale Brook drains agricultural and pastoral land in the headwaters and urban/ suburban areas at its confluence with the Gowy. The land use is mostly arable and horticultural.</p> <p>The Gale Brook flows northwest to the River Gowy, with headwaters starting around 1.18 km north west of Dunham-on-the-Hill (10 mAOD).</p>

<p><b>Study reach description</b></p>	<p>The channel appears to have been artificially straightened and is a trapezoidal cut channel in the study area. Bankfull width varies between 2.5 and 6 m, with water depth approximately 0.2 - 0.3 m.</p> <p>The channel bed material is homogenously silty.</p> <p>The riparian zone is characterised by a lack of riparian habitat and vegetation complexity. It is comprised of mostly tilled arable land on both banks with a narrow buffer comprising short and tall herbs and grasses. There are some areas of scrub, shrub and trees.</p> <p>Downstream of the study reach, the Gale Brook was reconfigured to flow beneath the Essar Stanlow Refinery but has maintained its planform since 1945.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The Gale Brook is crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.5. THORNTON UPLANDS



<b>Catchment area</b>	2.32km <sup>2</sup>
<b>Key hydraulic connections</b>	Thornton Uplands flows northwards to River Gowy. It is joined by Halls Green Lane Brook and Thornton Marsh Central.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	Thornton Uplands drains agricultural and pastoral land in the headwaters and is culverted as it flows under Ince Lane and track lanes. The channel rises from farm ditches, around 1.4 km southwest of Dunham-on-the-Hill (10 mAOD).
<b>Study reach description</b>	The watercourse is a trapezoidal cut channel, with obviously reshaped earth banks, with bankfull width between 3- 3.5 m and water depth approximately 0.03 m (within Newbuild Infrastructure Boundary).

	<p>The bed material is a mixture of sediment, with the presence of gravel – pebble sized sediments. There is evidence of some sand, with extensive silt and clay components. No organic materials were present at the time of survey.</p> <p>The riparian zone is mostly farmland with some residential and farm building. The banks comprise extensive bare earth, with some short creeping herbs and grasses, tall herbs and grasses. Scrubs, shrubs and a few trees and saplings were also noted on the bank top.</p> <p>The channel has maintained a similar planform since 1884 – 1900.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Thornton Uplands will be crossed by the Newbuild Carbon Dioxide Pipeline via open trench.</p>

## 2.6. THORNTON MAIN DRAIN



<b>Catchment area</b>	3.00km <sup>2</sup>
<b>Key hydraulic connections</b>	Thornton Ditches 5 – 12 drain into the Thornton Main Drain. The Thornton Main Drain joins the River Gowy at the A5117.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	<p>Thornton Main Drain drains agricultural and pastoral land in its headwaters, with the surrounding land uses being farmland, agricultural buildings and settlement, a landfill site, and a peat bog.</p> <p>The channel rises from farm ditches, around 0.7 km northwest of Wimbolds (6 mAOD).</p>



<p><b>Study reach description</b></p>	<p>The watercourse is an artificial cut channel, which has been artificially straightened and lacks geomorphic diversity. Bankfull width varies between 4.5 – 6m and depth between 0.8 - 1m.</p> <p>Bed material is mostly silt with extensive cover of unvegetated bare sediment, some emergent reeds and floating aquatic vegetation.</p> <p>The riparian zone is characterised by short herbs and grasses, extensive cover of tall herbs and grasses, emergent reeds and linear-leaved plants. Concrete bank protection and sheet piling farms the banks of the channel on the approach to the M56 culvert.</p> <p>The channel has maintained a similar planform since 1884 – 1900.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Thornton Main Drain is crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.7. RIVER GOWY



<b>Catchment area</b>	150km <sup>2</sup>
<b>Key hydraulic connections</b>	<p>The River Gowy is fed by the Barrow Brook, Back Brook, Milton Brook, Salters Brook and Ashton Brook upstream of the DCO Proposed Development. Downstream of the DCO Proposed Development, the River Gowy is joined by Thornton Main Drain, Thornton Uplands, Stanney Mill Brook and Gale Brook. The River Gowy flows into the River Mersey.</p> <p>The river is disconnected from its floodplain due to flood defences through most of its middle and lower course.</p>
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	The River Gowy drains the surrounding arable and horticultural land, in addition to a landfill site, settlement and peat bog.

	<p>There are a variety of geomorphic pressures (e.g. poor soil, nutrient, and livestock management, contaminated land, ecological discontinuity, ground water abstraction, pollution from wastewater industry and landfill). The catchment has a maximum elevation of 43 m ASL (Helsby Hill).</p>
<p><b>Study reach description</b></p>	<p>The channel is heavily modified, with generally shallow channel banks, obviously reshaped, and with set-back embankments. Bankfull width is 6.5 - 8 m and water depth is 0.8 - 1m. Some berms and eroding cliffs were noted within the Newbuild Infrastructure Boundary. Nest holes were observed in the channel banks.</p> <p>Bed material is silt with extensive cover of unvegetated bare sediment and some emergent and submerged aquatic vegetation. The riparian zone is mostly grazed pasture comprising predominantly grasses, creeping herbs and taller vegetation. The riparian zone is frequently wet.</p> <p>The confluence of the Gowy and Mersey has remained in the same place since at least 1892. However, the course of the Gowy upstream of this point has been heavily modified with evidence of straightening and realignment. The middle course of the channel has been canalised and flood embankments existing on both banks of the Gowy through the study reach.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The Gowy will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-09).</p>

## 2.8. STANNEY MAIN DRAIN



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	This is an artificial drain within the River Gowy floodplain. It is connected to Thornton Ditch (1,2), Mill Brook, Mill Brook Tributary (1,2) and Gowy Tributary (1,2). It joins the River Gowy at the A5117.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	Stanney Main Drain drains agricultural and pastoral land in its headwaters, with the surrounding land use being farmland, agricultural buildings and roadways. The catchment is boggy in the headwaters. The channel rises from farm ditches, around 0.47 km west of Bridge Trafford. It has a maximum catchment altitude of 6 mAOD.
<b>Study reach description</b>	Stanney Main Drain is a trapezoidal, cut and over deepened ditch that appears to have been artificially straightened. Bankfull width is

	<p>approximately 5.5 m and water depth approximately 0.5 m, with benches present on the banks of the channel.</p> <p>Bed material is silt with extensive cover of bare sediment. The riparian zone is grazed farmland comprising short grasses with some tall herbs and grasses, shrubs and scrub and some emergent reeds/linear-leaved/horsetails on the banks.</p> <p>The channel has retained its planform, as a network of cut ditches, since 1885 though some sections have been realigned. Following construction of the Ellesmere Port Oil Refinery (post 1949 –1965), the confluence with the Gowy was moved further upstream to the south of the A5117 (approx., 420 m downstream from the contemporary position).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Stanney Main Drain will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.9. STANNEY MILL BROOK



<b>Catchment area</b>	6.95km <sup>2</sup>
<b>Key hydraulic connections</b>	<p>Gowy Tributary 2 connects Stanney Mill Brook and Stanney Main Drain. Picton Brook flows into the Stanney Mill Brook. The Stanney Mill Brook drains into the Gowy downstream of the A5117.</p> <p>There is a wastewater treatments works on the Stanney Mill Brook south of the A5117 into which the watercourse may outfall, though this is unconfirmed.</p> <p>Within the Newbuild Infrastructure Boundary the watercourse is disconnected from its floodplain.</p>
<b>River Condition Score</b>	Moderate – Fairly Poor

<p><b>Catchment description</b></p>	<p>Stanney Mill Brook drains agricultural and pastoral land, with the surrounding land uses being farmland, agricultural buildings, roadways, suburban (Picton, Mickle Trafford) and peat bogs.</p> <p>It has a maximum catchment altitude of (45 mAOD).</p>
<p><b>Study reach description</b></p>	<p>The watercourse is a cut channel that has been artificially straightened and has a bankfull width of 4 - 7m and water depth of 0.05 – 0.5m.</p> <p>Bed material is mostly silt, with some bare unvegetated bed and berms present. The channel is choked with vegetation. The riparian zone is predominantly grazed farmland comprising short grasses, The banks have extensive cover of emergent reeds/linear-leaved/horsetails, along with some short and tall herbs and grasses.</p> <p>Stanney Mill Brook has retained the same form since 1913.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Stanney Mill Brook will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.10. BACKFORD BROOK



<b>Catchment area</b>	4.97 km <sup>2</sup>
<b>Key hydraulic connections</b>	There are three tributaries of Backford Brook which drain land south of Dunkirk and the M56. Backford Brook is culverted beneath the Shropshire Union Canal and then joins Finchetts Gutter.
<b>River Condition Score</b>	Fairly Good upstream of field culvert. Fairly Poor downstream of field culvert.
<b>Catchment description</b>	The catchment is predominantly rural, with the main land uses being pasture, grassland, and woodland. Elevation varies from 38m to 19mAOD.
<b>Study reach description</b>	Upstream of the field culvert, the channel varies in width and depth, but it has approximately 0.5m and bankfull width is approximately 1.1m throughout the studied reach. The Backford Brook has a sinuous channel, with step-pools created by log jams, thus providing good in-



	<p>channel habitat diversity. In addition, there are mature trees lining the channel with fallen trees and extensive large wood habitat along the reach upstream of the field boundary culvert.</p> <p>Downstream of the field culvert the watercourse flows through a modified reach featuring armoured banks and a trapezoidal cross section. The riparian zone in this reach has fewer trees and fallen trees and uninterrupted flow.</p> <p>The river bed substrate is made of sand and silt, with traces of organic matter. The riparian zone is mostly pasture, with a single line of mature trees along the bank top of the watercourses. The treeline is more mature in the reach upstream of the field culvert.</p> <p>No change in planform can be seen from existing online maps (from 1982 onwards).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Backford Brook will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.11. SEAHILL DRAIN



<b>Catchment area</b>	3.03 km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse has several tributaries and merges with the Garden City Gutter before reaching the River Dee.
<b>River Condition Score</b>	Fairly poor
<b>Catchment description</b>	The Seahill Drain catchment has a high degree of human influence on watercourses and landscape, with the land use being arable agriculture and permanently vegetated recreational. Elevation varies from ~ 25m to 5mAOD.
<b>Study reach description</b>	Seahill Drain is a linear watercourse, with no significant variation in water depth and along the investigated reach. Mean water depth and width are 0.45m and 2.1m, respectively.

	The riverbed morphology is slow-glide with silt as the dominant particle size. The riparian zone is arable agriculture.
<b>Interaction with the DCO Proposed Development</b>	Seahill Drain will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.

## 2.12. SEALAND MAIN DRAIN



<b>Catchment area</b>	6.74km <sup>2</sup>
<b>Key hydraulic connections</b>	The Sealand Main Drain receives water from the Seahill Drain and the Garden City Gutter before flowing to the River Dee. The watercourse is disconnected from its floodplain.
<b>River Condition Score</b>	Fairly poor
<b>Catchment description</b>	The catchment is marked by several artificial watercourses; therefore, it is unlikely to reflect the original geometry. The current catchment drains tilled farm land, pasture, grassland, woodland, and urban areas.
<b>Study reach description</b>	The channel is artificially incised in order to store and channel flood flows to the River Dee, with watercourse geometry minimal. Water width is ~ 1.1m, and water depth is ~ 0.15m.

	<p>The bed material is largely dominated by silt particles and low morphological diversity. The riparian zone is primarily arable agriculture.</p> <p>No change in planform can be seen from existing online maps (from 1982 onwards).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Sealand Main Drain will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut. The watercourse will also be crossed by construction vehicles in two other locations using existing access tracks via existing bridges / culverts.</p>

## 2.13. DEE ESTUARY



<b>Catchment area</b>	136.7 km <sup>2</sup>
<b>Key hydraulic connections</b>	The Dee is the downstream receptors of many watercourses scoped into this assessment. The Dee is tidal up to Chester and flows out to the North Wales coastal water body.
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	<p>Major estuary with extensive mudflats and saltmarsh habitat, with entire estuary area designated as a SAC, SSSI and SPA. Land use is a mix of rural agriculture, industrial, urban areas (Flint, West Kirby, Neston, Heswall, Connah's Quay and the City of Chester at the historic head of the estuary).</p> <p>Estuary is macrotidal, with a 7.7mAOD tidal height on a spring tide and a 4.1mAOD tidal height on a neap tide. Approximately 90% of the estuary area is estimated to dry out in a large spring low tide.</p>

<p><b>Study reach description</b></p>	<p>The Dee through the Newbuild Infrastructure Boundary is homogenous with a channel width of approximately 90m. There are flood embankments on both banks with the left bank embankment set back approximately 30m from the channel. The channel bank showed signs of slumping due to repetitive wetting and drying due to the tidal flows in the channel.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The Dee will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-28). It is also the downstream receptor of several watercourses which are crossed using open cut.</p>

## 2.14. HAWARDEN BROOK



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	The Hawarden Brook discharges to the River Dee. There is a flow control structure on the confluence of the watercourse with the Dee to prevent tidal flows from entering Hawarden Brook.



<b>River Condition Score</b>	Not surveyed due to land access restrictions
<b>Catchment description</b>	This watercourse and its small low-lying catchment have been heavily modified by the constriction of the Dee and draining of the floodplain. The predominant land use is pastoral farming and the airfield.
<b>Study reach description</b>	Downstream of the B5129 the watercourse flows through an artificially incised, re-sectioned channel with a trapezoidal cross section.  Whilst the channel is mostly unchanged since 1988, the catchment was heavily modified by the construction of the Airbus factory and runway.
<b>Interaction with the DCO Proposed Development</b>	The watercourse is not crossed by the Newbuild Carbon Dioxide Pipeline It will be crossed via a new temporary crossing during the construction phase.

## 2.15. BROUGHTON BROOK



<b>Catchment area</b>	11.72km <sup>2</sup>
<b>Key hydraulic connections</b>	<p>The Broughton Brook flows to the River Dee at Station Road. Along the B5129 it is joined by several tributaries flowing north-eastwards from Hawarden. There are drains along Chester Road which connect to the Broughton Brook prior to it joining the River Dee.</p> <p>The watercourse is disconnected from its floodplain as it is within an incised channel.</p>
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	The catchment has a high degree of human influence on watercourses and the landscape, with the surrounding land use predominantly arable farming, improved grassland and woodland. Elevation varies from ~ 157 mAOD to 8mAOD.

<p><b>Study reach description</b></p>	<p>Broughton Brook channel is a cut trapezoidal drainage ditch, with consistent a bankfull width and water depth of 2m and 0.25m, respectively.</p> <p>The bed material is predominantly silt with some gravels and pebbles. Whilst the watercourse has a bare channel bed, there are some emergent reeds/ linear leaved or horsetails. The riparian zone is homogenous throughout the study area, with taller grasses on bank face and bank top, the B5129 on one bank and arable farming on the other.</p> <p>The planform of the channel has remained unchanged since 1913.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The Broughton Brook will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-30).</p>

## 2.16. SANDYCROFT DRAIN



<b>Catchment area</b>	2.99km <sup>2</sup>
<b>Key hydraulic connections</b>	Onward connection into Broughton Brook. It receives flows from roadside ditches of Moor Lane.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	The catchment drains the surrounding roads, urban areas, and arable fields and is relatively flat, with the elevation varying from 80 - 8 mAOD.
<b>Study reach description</b>	<p>The channel is a cut trapezoidal drainage ditch that appears to have been artificially straightened. The channel has a consistent bankfull width and water depth (1m and 0.05m, respectively).</p> <p>The bed material is predominantly silt with some sands. Whilst the channel bed sediment is bare, there are some emergent broadleaved and amphibious plants. The riparian zone is homogenous, with a</p>

	<p>hedgerow between the channel and the adjacent pastoral fields on one bank. The majority of the riparian zone is fields or road infrastructure.</p> <p>The planform of the channel has remained unchanged since 1913.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The Sandycroft Drain will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-30) where it is parallel with Broughton Brook. At Moor Lane, the watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

## 2.17. CHESTER ROAD DRAIN NORTH



<b>Catchment area</b>	1.67 km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse is hydraulically connected to both the Broughton Brook (southeast) and Aston Hall Brook (Northwest). The channel is not connected to the floodplain.
<b>River Condition Score</b>	Poor
<b>Catchment description</b>	The catchment drains farmland and arable fields, with extensive urbanisation north of the watercourse. The catchment is relatively flat catchment, with the elevation varying from 80 – 8 mAOD.
<b>Study reach description</b>	Large sections of the watercourse are culverted or in an artificially incised channel with steep banks, with no variation in channel width (bankfull width 4 m) and depth (0.3 m) within the study area.

	<p>The watercourse has a silt substrate, with a lack of geomorphic bed features. There is a lack of diversity in the riparian vegetation; however, in the open sections there is defunct hedgerow on the bank top with road and car parking within the riparian zone. There is bare earth on the bank faces, with some short creeping herbs and grasses</p> <p>Despite becoming progressively culverted, the channel has retained its contemporary planform since at least 1892.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>This watercourse is within the Newbuild Infrastructure Boundary. The pit for the proposed trenchless crossings of Chester Road (TRS-31 and TRS-32) would be adjacent to this watercourse.</p>

## 2.18. CHESTER ROAD DRAIN TRIBUTARY 1 AND 2



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Onwards connection to Chester Road Drain North. The channel is not connected to the floodplain.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	The catchment drains farmland and arable fields with extensive urbanisation to the north of the watercourse. It has a relatively flat catchment, with elevation varying from 80 - 8 mAOD.
<b>Study reach description</b>	The channel has a rectangular cross section with a consistent bankfull river width of 2.5m and water depth of 0.25m.



	<p>The channel has a predominantly silt substrate with a lack of geomorphic diversity and bedforms. The riparian zone on the left bank is arable farmland, whilst on the right bank it is road infrastructure.</p> <p>Despite becoming progressively culverted, the channel has retained its contemporary planform since at least 1892.</p>
<b>Interaction with the DCO Proposed Development</b>	<p>This watercourse is within the Newbuild Infrastructure Boundary. The pit for the proposed trenchless crossing of Chester Road (TRS-31 and TRS-32) would be adjacent to this watercourse. The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline however the method is not yet determined.</p>

## 2.19. WESTERN BOUNDARY DRAIN

<b>Catchment area</b>	0.5km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows northwards and connects to West Central Drain.
<b>River Condition Score</b>	The watercourse is in a culvert within the Newbuild Infrastructure Boundary therefore it is assigned Poor condition
<b>Catchment description</b>	The catchment is mostly comprised of arable and horticultural land with some areas of woodland, marshes, industrial and residential land use. The catchment's elevation ranges between approximately 3m to 36m AOD.
<b>Study reach description</b>	A watercourse survey has not been undertaken at this site.
<b>Interaction with the DCO Proposed Development</b>	The extension of the Newbuild Infrastructure Boundary to enable access to Ince AGI from the adopted highway (PS06) includes a small section of the Western Boundary Drain which flows through a culvert beneath Grinsome Road.

### 3. ORDINARY WATERCOURSES

#### 3.1. GLASS FACTORY DITCH



<b>Catchment area</b>	1.41km <sup>2</sup>
<b>Key hydraulic connections</b>	Glass Factory Ditch connects to the West Central Drain and Ince Marshes.
<b>River Condition Score</b>	Fairly Poor

<b>Catchment description</b>	The majority of the catchment is used for industrial purposes.
<b>Study reach description</b>	The watercourse flows through a straightened channel with re-sectioned banks. There are some concrete structures within the channel, likely used for sluices and penstocks historically. The watercourse is culverted beneath two access tracks before joining the West Central Drain.
<b>Interaction with the DCO Proposed Development</b>	The watercourse is not crossed by the Newbuild Carbon Dioxide Pipeline however it will be crossed by vehicles via existing access tracks via existing bridges / culverts.

### 3.2. ELTON LANE DITCH 1, 2, 4 AND 6



**Elton Lane Ditch 1**

**Elton Lane Ditch 4**

<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Ephemeral watercourses which connect to West Central Drain and East Central Drain
<b>River Condition Score</b>	Poor (Ditch survey) (Elton Lane Ditch 1, 2 and 6) Moderate (Ditch survey) (Elton Lane Ditch 4)
<b>Catchment description</b>	Grazed farmland which is historically coastal and fluvial marshland which has been drained via a series of ditches and pumping.
<b>Study reach description</b>	The ditches within the Newbuild Infrastructure Boundary are narrow channels artificially cut around field boundaries. These ditches are ephemeral and have simple vegetation structures.

<b>Interaction with the DCO Proposed Development</b>	Elton Lane Ditch 1 and 4 will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut. Other ditches are located within the Newbuild Infrastructure Boundary. Elton Lane Ditch 1 is currently culverted beneath a field access. This culvert will be replaced with a longer culvert to provide permanent access to Ince AGI. Ince AGI is located within 10m of Elton Lane Ditch 1 and 2.
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### 3.3. ELTON LANE SOUTH DITCH

<b>Catchment area</b>	<1km2
<b>Key hydraulic connections</b>	Elton Lane South Ditch joins the West Central Drain.
<b>River Condition Score</b>	Not surveyed due to access restrictions.
<b>Catchment description</b>	Grazed farmland and private railway.
<b>Study reach description</b>	The ditch was not surveyed due to access restrictions.
<b>Interaction with the DCO Proposed Development</b>	The ditch would be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-01).

### 3.4. ELTON MARSH 1, 2, 3, 10, 11, 12, AND 13



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Elton marsh ditches are all connected to the West Central Drain which is part of the wider Ince Marshes.
<b>River Condition Score</b>	Poor (Ditch survey)
<b>Catchment description</b>	Grazed farmland which is historically coastal and fluvial marshland which has been drained via a series of ditches and pumping.
<b>Study reach description</b>	The ditches are straight shallow ephemeral channels which have been artificially cut in order to drain the marshland. The floodplain is frequently flooded.

<b>Interaction with the DCO Proposed Development</b>	Elton Marsh 1, 2,3, 11, 12 and 13 could be crossed by the Newbuild Carbon Dioxide Pipeline via open cut. The exact route of the Newbuild Carbon Dioxide Pipeline is not determined at this stage.
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### 3.5. ELTON BROOK TRIBUTARY 1



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Flows westwards into Gale Brook. The ditch is disconnected from its floodplain by incision and artificial bunding.
<b>River Condition Score</b>	Poor

<b>Catchment description</b>	Elton Brook Tributary 1 drains arable and horticultural land to the south of the A5117 and includes both the Essar Stanlow Refinery and the suburb of Elton.
<b>Study reach description</b>	<p>The channel is a cut trapezoidal, cut ditch with bunding along its south bank. There is potential evidence of physical damage along the ditch. It is unlikely that water levels are maintained throughout the summer (likely less than 50cm in depth).</p> <p>The bed material is comprised of silt and organic accumulation. The riparian zone is characterised by a lack of both marginal and aquatic vegetation.</p> <p>The Elton Brook Tributary 1 was formed between 1965 –1970 and the channel has maintained its contemporary position since its construction. However, a travellers' site was constructed in the location of the drain between 2009 –2010 creating bunding on the south bank.</p>
<b>Interaction with the DCO Proposed Development</b>	Elton Brook Tributary 1 will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-05 and TRS-06).

### 3.6. HALLS GREEN LANE BROOK

<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Halls Green Lane Brook drains into the Thornton Uplands. The watercourse is disconnected from its floodplain.
<b>River Condition Score</b>	Poor
<b>Catchment description</b>	Thornton Uplands drains agricultural and pastoral land in the headwaters. The channel rises from farm ditches, around 1.4 km southwest of Dunham-on-the-Hill (10 mAOD).
<b>Study reach description</b>	<p>The watercourse is a trapezoidal cut channel that appears to have been artificially straightened along the side of Halls Green Lane. There is potential evidence of physical damage along the ditch. It is unlikely that water levels are maintained throughout the summer (likely less than 50cm in depth).</p> <p>The bed material is comprised of silt and organic accumulation. The riparian zone is characterised by a lack marginal vegetation and a lack of diversity of aquatic vegetation.</p> <p>The channel has maintained a similar planform since 1884 – 1900.</p>
<b>Interaction with the DCO Proposed Development</b>	Halls Green Lane Brook may be crossed by the Newbuild Carbon Dioxide Pipeline via open cut (depending on the final alignment of the Newbuild Carbon Dioxide Pipeline ).

### 3.7. THORNTON DITCH 1, 2, 3, 4, 5 AND 6



**Thornton Ditch 4**

**Thornton Ditch 5**

<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Thornton Ditches 1 and 2 connect to Stanney Main Drain whilst Thornton Ditches 3, 4, 5 and 6 connect to Thornton Main Drain, both of which discharge to the River Gowy north of the DCO Proposed Development.
<b>River Condition Score</b>	Thornton Ditch 1: Moderate (Ditch survey) Thornton Ditch 2, 3, 4, 5 and 6: Poor (Ditch survey)
<b>Catchment description</b>	The catchment is predominantly grazed farmland or peat bog, most of which is within the fluvial floodplain of the River Gowy and is frequently wet.
<b>Study reach description</b>	All the ditches are artificial straight trapezoidal channels designed to drain the floodplain so it can be used for agriculture.  Thornton Ditch 1 and 2 are ephemeral and covered in short grasses with some taller reeds.

	<p>Thornton Ditch 3, 4, 5 and 6 are wider ditches which are likely to hold water all year round. Approximate bankfull width is 3m and water depth is 0.5m.</p> <p>Bed material is silt.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>All Thornton Ditches are within the Newbuild Infrastructure Boundary. They may be crossed by the Newbuild Carbon Dioxide Pipeline via open cut, however the exact location of the Newbuild Carbon Dioxide Pipeline is not determined at this stage.</p>

### 3.8. GOWY TRIBUTARY 2



<b>Catchment area</b>	1.1 km <sup>2</sup>
<b>Key hydraulic connections</b>	Gowy Tributary 2 flows into Stanney Mill Brook and the River Gowy. At the proposed site access crossing, for where vehicles will be crossing to access the working corridor, the channel is connected to its floodplain. Nearer to the Gowy, the watercourse is in an incised ditch and disconnected from the floodplain.
<b>River Condition Score</b>	Access reach: Moderate Stoak reach: Fairly Poor.
<b>Catchment description</b>	Gowy Tributary 2 drains the surrounding arable, horticultural, and suburban land. The channel rises west of Upton Health. It has a maximum catchment altitude of 42 mAOD.

<p><b>Study reach description</b></p>	<p>The channel appears to have been artificially straightened and has reshaped banks at the three locations where surveys were carried out. Bankfull river width is 1.5 - 2.75m and water depth is 0.05 - 0.1m.</p> <p>The bed material is comprised of gravel and pebbles, but mostly silts and clays with extensive coverage of bare sediment. The riparian zone is largely extensive cover of bare earth, with some vegetation and evidence of bank erosion (j-shaped and leaning trees).</p> <p>Gowy Tributary 2 has retained the same form since 1913.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>Three sections of Gowy Tributary 2 are within the Newbuild Infrastructure Boundary. It is anticipated that the watercourse would not be crossed by the Newbuild Carbon Dioxide Pipeline as the exact location is not yet determined. However if crossed, it would be via open cut.</p> <p>The most upstream surveyed section will be crossed by a new temporary access track during the construction phase.</p>

### 3.9. WERVIN HALL DITCH TRIBUTARY



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Flows into Wervin Hall Ditch which flows under the Shropshire Union Canal and joins Canal Ditch; part of Finchetts Gutter water body.
<b>River Condition Score</b>	Poor
<b>Catchment description</b>	Wervin Hall Ditch Tributary drains agricultural and pastoral land. The channel rises east of Caughall road, with a maximum catchment altitude of circa 39 mAOD. The surrounding land use is farmland, agricultural buildings, roadways, Shropshire Union Canal and plantation woodland.
<b>Study reach description</b>	The incised, cut channel appears to have been artificially straightened. The ditch is likely to be ephemeral.



	<p>The bed material is sand, silt and gravel. The riparian zone has a lack of emergent, submerged, and floating leaved plants with some signs of potential eutrophication.</p> <p>The channel planform has remained consistent since 1892.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The ditch will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-17).</p>

### 3.10. CANAL DITCH

<b>Catchment area</b>	1.74km <sup>2</sup>
<b>Key hydraulic connections</b>	Canal ditch flows westwards parallel to the canal. It is joined by Colling Wood Brook and Rake Lane Brook before it joins Backford Brook which becomes Finchetts Gutter.
<b>River Condition Score</b>	Not surveyed due to land access restrictions
<b>Catchment description</b>	A small catchment of predominantly arable land.
<b>Study reach description</b>	This watercourse has not been surveyed due to land access restrictions. The banks and surrounding land are heavily vegetated with grasses and scrub.
<b>Interaction with the DCO Proposed Development</b>	The watercourse will receive runoff from Rock Bank BVS. It will not be crossed by the Newbuild Carbon Dioxide Pipeline.

### 3.11. COLLINGE WOOD BROOK



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Onward connection to canal ditch and is likely culverted beneath Shropshire Union Canal to join Finchetts Gutter.
<b>River Condition Score</b>	Not surveyed
<b>Catchment description</b>	Drains agricultural and pastoral land. The surrounding land use is farm buildings and tracks, improved grassland, arable and horticultural land, some broadleaved and mixed and yew woodland.  Catchment altitude varies between ~ 42 mAOD - ~11mAOD.
<b>Study reach description</b>	The cut channel has been re-sectioned, over deepened and artificially straightened. The channel has rectangular and trapezoidal sections with gently sloping banks and a bankfull width of ~1.5m,

	<p>The bed material is fine, with no visible channel bed features. The bed of the channel is unconsolidated. There is a continuous riparian buffer along right bank, which has a uniform and simple riparian zone structure. The bank materials are composed of cohesive earth. There is simple bank face vegetation, with a semicontinuous tree line on the right bank.</p> <p>The channel has retained the same planform since 1892.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

### 3.12. RAKE LANE BROOK



<b>Catchment area</b>	3.3km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows beneath the Shropshire Union Canal and joins Finchetts Gutter.
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	The watercourse is ~ 0.7km long, with the surrounding land use being pasture, grassland, and woodland. Elevation varies from 24m to 20mAOD.
<b>Study reach description</b>	The watercourse has a shallow and narrow wetted channel. At the time of the survey it had a water depth of 0.05m. Channel width varied between 0.5 and 0.8m.

	<p>The riverbed substrate is rich in silt and organic particles. The riparian zone is primarily permanently vegetated agricultural land use. The fields on both banks are grazed and there is a hedgerow along the right bank.</p> <p>No change in planform can be seen from existing online maps (from 1982 onwards).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

### 3.13. FRIARS PARK DITCH



<b>Catchment area</b>	0.135km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows southeast, under the Shropshire Union Canal and connects to Finchetts Gutter.
<b>River Condition Score</b>	Fairly Good
<b>Catchment description</b>	The watercourse drains a catchment south of Lea-by-Backford in which the land use is characterised as pasture, grassland, and woodland. The elevation ranges from 12m to 25mAOD.
<b>Study reach description</b>	The watercourse is in a deep channel much lower than the surrounding pasture, with water depth varying from 0.03m to 0.15m, and river width from 0.3m to 0.5m.  The river bed substrate is dominated by silt with organic matter overlaying the silt. The riparian zone is primarily composed of

	<p>permanently vegetated agriculture. There is a line of mature trees along the bank top of the watercourse, with more vegetation on the bank face.</p> <p>No change in planform can be seen from existing online maps (from 1982 onwards).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut. Construction vehicles will also cross this watercourse via the existing crossing to the south of the potential crossing location.</p>



### 3.14. GROVE ROAD DITCH

<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	The connections of Grove Road Ditch are not confirmed. It is likely that it connects to Gypsy Lane Brook.
<b>River Condition Score</b>	Not surveyed.
<b>Catchment description</b>	Small catchment comprising farmland and rural settlement.
<b>Study reach description</b>	This watercourse was not surveyed. It is a small roadside ditch along a field boundary.
<b>Interaction with the DCO Proposed Development</b>	The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.

### 3.15. GYPSY LANE BROOK



<b>Catchment area</b>	1.51 km <sup>2</sup>
<b>Key hydraulic connections</b>	Network of hedgerow ditches, which flows southeast, beneath the Shropshire Union Canal and then joins Finchetts Gutter.  The watercourse is disconnected from the floodplain.
<b>River Condition Score</b>	No survey completed
<b>Catchment description</b>	The catchment includes local farmland and arable fields, along with the urban development Lea by Backford. It has an elevation range between 14 and 41 mAOD.
<b>Study reach description</b>	The watercourse has a straight channel planform and rectangular and trapezoidal cross section. It has been resectioned, over-deepened and

	<p>artificially straightened. Channel depth is around 1.5 m, and bankfull width is around 1.5m</p> <p>At time of survey there was an obscured view of the channel bed, precluding identification of the channel bed material. Within the Newbuild Infrastructure Boundary, the riparian zone includes a hedgerow along the right bank of the channel though predominant land use is arable and pastoral farming. There is simple bank top and bank face vegetation.</p> <p>The channel has retained its planform since 1892.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

### 3.16. OVERWOOD DITCH



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Overwood Ditch flows southwards towards Finchetts Gutter Tributary. There is a pond which flows into Overwood Ditch.
<b>River Condition Score</b>	No survey completed.
<b>Catchment description</b>	This is a small catchment which is dominated by agricultural land uses.
<b>Study reach description</b>	<p>The watercourse has a straight channel planform and rectangular and trapezoidal cross section. It has been resectioned, over-deepened and artificially straightened.</p> <p>At time of survey there was an obscured view of the channel bed, precluding identification of the channel bed material. Based on catchment land use and gradients, bed material is likely to be fine material such as</p>

	<p>silt. Within the Newbuild Infrastructure Boundary, there is a hedgerow along both banks of the channel, though the predominant land use within the riparian zone is pastoral farming. There is simple bank top and bank face vegetation.</p> <p>The channel has retained its planform since 1892.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will receive runoff from Mollington BVS.</p> <p>It may be crossed by the Newbuild Carbon Dioxide Pipeline as the exact alignment has not yet been determined.</p>

### 3.17. FINCHETTS GUTTER TRIBUTARY



Fairly Good section within Newbuild Infrastructure Boundary



Moderate section within Newbuild Infrastructure Boundary

<b>Catchment area</b>	3.21km <sup>2</sup>
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<b>Key hydraulic connections</b>	Finchetts Gutter Tributary flows southeast towards Blacon, under which it is culverted. It joins the Finchetts Gutter south of Saughall Road.
<b>River Condition Score</b>	Fairly good in the upper reach and moderate in the lower reach within the Newbuild Infrastructure Boundary.
<b>Catchment description</b>	<p>The catchment is rural in nature, with mainly open farmland and has some small areas of trees standing. Relatively shallow gradient and unconfined floodplain.</p> <p>The watercourse is approximately 7 km in length, with an elevation range between 10 and 46 mAOD. The catchment drains local farmland and arable fields</p>
<b>Study reach description</b>	<p>The channel is slightly sinuous, although it appears to have realigned for agriculture in the past. Bankfull width is up to 10m in some locations within the study reach. Water depths are shallow, at approximately 0.2m on average throughout surveyed reach.</p> <p>The bed material is primarily gravel and pebble, with areas of sand and silt present on channel bed. Within the riparian zone, the is channel lined with trees and scrub on both banks. Beyond the immediate treeline there is agricultural land on both banks.</p> <p>No significant changes in channel course since the 1<sup>st</sup> edition OS maps (1888)</p>
<b>Interaction with the DCO Proposed Development</b>	This watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.

### 3.18. SEAHILL TRIBUTARY 2



<b>Catchment area</b>	0.270km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse has no tributaries. This watercourse joins the Seahill Drain at its downstream end.
<b>River Condition Score</b>	Fairly poor
<b>Catchment description</b>	Highly modified catchment, in which the land use is arable agriculture. The total watercourse length is 0.5km, and the elevation changes from 5mAOD to 20mAOD.
<b>Study reach description</b>	Watercourse geometry is minimal throughout the study area. Water width is ~ 0.5m, and water depth is ~ 0.02m.  The bed is dominated by silt particles and low morphological diversity. The riparian zone is primarily arable agriculture.



	No change in planform can be seen from existing online maps (from 1982 onwards).
<b>Interaction with the DCO Proposed Development</b>	The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.

### 3.19. RAILWAY DITCHES 1 AND 2



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	The railway ditches are ephemeral. It is assumed that they connect to Hawarden Brook which flows northwards to the Dee Estuary.
<b>River Condition Score</b>	Poor
<b>Catchment description</b>	Small catchment modified by artificial drains and the railway. The surrounding land use is predominantly arable and horticultural, with some urban development.
<b>Study reach description</b>	These are small ditches, and the bed material is mostly silt and organic matter. The riparian zone is heavily modified, a railway embankment on one side of the ditch and farmland on the other side. There is an absence of marginal vegetation along most of the ditches. Since 1913, the channel has retained its planform.

<b>Interaction with the DCO Proposed Development</b>	These watercourses will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-29).
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**3.20.**

**MANCOT BROOK AND TRIBUTARY**



**Mancot Brook - Downstream Reach**



**Mancot Brook - Upstream Reach**



**Mancot Brook Tributary**

<b>Catchment area</b>	1.66km <sup>2</sup>
<b>Key hydraulic connections</b>	Onward connection into Chester Road Drain South, which flows beneath the B5129 to join the Broughton Brook.
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	<p>The catchment is predominantly rural, thus mostly draining farmland and arable fields. This comprises improved and neutral grassland, broadleaved, mixed and yew woodland.</p> <p>The catchment is relatively flat, with the elevation varying from 80 - 8 mAOD.</p>
<b>Study reach description</b>	<p>The channel is incised in places, with bankfull channel width varying between 1.5-3m, whilst water depth is between 0.05 – 0.07m.</p> <p>The channel has a silt substrate with extensive cover of bare earth. Some broad and linear leaved aquatic vegetation is present. At the location of the upstream proposed open cut crossing, the riparian zone is dominated by short grassland pasture. At the downstream proposed crossing location there is a hedge along the left bank and a private drive on the right bank within the riparian zone.</p> <p>Since 1913, the channel has retained its planform as a drainage channel to the surrounding arable land. The channel has been elongated to follow field boundaries, therefore resulting in a shallower gradient compared to its likely natural state.</p> <p>Mancot Brook Tributary is ephemeral and flows through a grazed pasture. It has extensive grass cover to bed and banks.</p>
<b>Interaction with the DCO Proposed Development</b>	This watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline up to three times via open cut.

### 3.21. OAKFIELD DITCH 1 AND 3



<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	The exact connections of these ditches are unknown however it is likely that water drains toward Chester Road Drain North, Broughton Brook and the Dee.
<b>River Condition Score</b>	Not surveyed
<b>Catchment description</b>	Small catchment of arable and grazed farmland.
<b>Study reach description</b>	The watercourse flows along a field boundary. It has a hedgerow along one bank.
<b>Interaction with the DCO Proposed Development</b>	Oakfield Ditch 3 will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut. Oakfield Ditch 1 is located within the Newbuild Infrastructure Boundary and may be crossed via open cut.

### 3.22. WILLOW PARK BROOK



**Upstream Fairly Poor reach**



**Downstream Moderate reach**

<b>Catchment area</b>	0.55km <sup>2</sup>
<b>Key hydraulic connections</b>	The Willow Park Brook flows north-eastwards to Chester Road Drain North.

<b>River Condition Score</b>	Upstream reach is Fairly Poor Downstream reach is Moderate
<b>Catchment description</b>	Relatively small catchment comprising agricultural fields and residential estates. There is a small on-line pond in the upper catchment.
<b>Study reach description</b>	Bankfull channel width varies between 1m and 2m. Depth varies between 0.3 and 1.5m.  The substrate primarily comprises gravels and pebbles, with some silt and sand deposits, potentially introduced due to poaching activity.  The channel is extensively poached, with hardcore/rubble used for partial bank protection on the right bank. Riparian vegetation is mostly short grasses and isolated trees on the right bank with hedgerow on the left bank. The bank top land use is pastoral farming.
<b>Interaction with the DCO Proposed Development</b>	The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.



### 3.23. ASTON HALL BROOK TRIBUTARY

<b>Catchment area</b>	<1km <sup>2</sup>
<b>Key hydraulic connections</b>	Aston Hall Brook Tributary flows northwards towards Deeside where it joins Aston Hall Brook.
<b>River Condition Score</b>	No survey completed (culvert)
<b>Catchment description</b>	This watercourse drains a predominantly rural and suburban catchment.
<b>Study reach description</b>	Within the Newbuild Infrastructure Boundary the watercourse is located within a culvert. This flows adjacent to a children's' playground and arable fields.
<b>Interaction with the DCO Proposed Development</b>	The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless methods (TRS-35). The watercourse receive runoff from Aston Hill BVS.

### 3.24. ASTON HALL BROOK



<b>Catchment area</b>	<0.5km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows north-eastwards towards Deeside. It is joined by two tributaries before joining the Dee.  The valley is steep, so the watercourses is not connected to a floodplain.
<b>River Condition Score</b>	Fairly poor
<b>Catchment description</b>	The catchment is very small, with the surrounding land use predominantly rural farmland and suburban residential areas. The watercourse is potentially ephemeral.
<b>Study reach description</b>	The channel has been over deepened and had shallow water depth of approximately 0.05m at the time of survey. Bankfull width was observed to be between 1.5m and 3m.  The bed material is mainly composed of sand and silt, with some concrete reinforcement on bed through some private gardens. The

	<p>riparian zone on the right bank is comprised of short grasses and pastoral farming, with a mixture of vegetation where it flows through private gardens.</p> <p>No changes recorded since 1<sup>st</sup> edition OS map.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>This watercourse is within the Newbuild Infrastructure Boundary but is not crossed by the Newbuild Carbon Dioxide Pipeline.</p>

### 3.25. NEW INN BROOK



<b>Catchment area</b>	2.68km <sup>2</sup>
<b>Key hydraulic connections</b>	Downstream connectivity to Wepre Brook
<b>River Condition Score</b>	Fairly Good
<b>Catchment description</b>	<p>The catchment drains farmland and arable fields. The catchment is predominantly rural though there is extensive urbanisation in the upper catchment (Buckley).</p> <p>Elevation varies from 166 - 62 mAOD.</p>
<b>Study reach description</b>	<p>The watercourse has shallow channel banks, a bankfull width around 0.7m and channel depth around 0.2m. At the downstream end of the reach within the Newbuild Infrastructure Boundary the watercourse becomes multi-thread.</p>

	<p>The bed material is predominantly a silt substrate with some clays and sands. The channel bed has some linear leaved vegetation growing at the margins and the channel bed is covered in fine layer of debris.</p> <p>The riparian zone on the left bank is historically pasture which has been left unused and has therefore grown more mature vegetation which is dominated by long grassy vegetation, shrubs and scrub. On the right bank the riparian zone includes mixed hedgerow and arable fields.</p> <p>The channel has retained a similar planform since 1898 but has been culverted where developments have been implemented (post 1949).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>This watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

### 3.26. ALLTAMI BROOK



<b>Catchment area</b>	6.52 km <sup>2</sup>
<b>Key hydraulic connections</b>	The Alltami Brook joins Wepre Brook downstream of the Newbuild Infrastructure Boundary and has approximately 10 tributaries upstream of the study area.
<b>River Condition Score</b>	Fairly Good
<b>Catchment description</b>	The catchment drains farmland and arable fields. There is extensive urbanisation in the upper catchment (Buckley, New Brighton). Downstream the watercourse flows through a narrow gorge to Wepre Brook. There is a clay quarry within the catchment.  Elevation varies from 170 - 76 mAOD.
<b>Study reach description</b>	The watercourse flows through a naturally deep valley, with bankfull width varying between 6 – 7 m and water depth between 0.2 – 0.3 m. There is varied roughness through the reach which has pools, riffles,

	<p>steps and glides. There is some active bank erosion with undercut banks within the study reach.</p> <p>The predominant structure of the river bed is bedrock which is overlain with some boulders, cobble, gravel and silts, with some bedrock outcrops throughout the reach. The Alltami Brook has an unvegetated channel bed. Within the riparian zone, the bank top comprises mature woodland on the left bank and pasture on the right bank.</p> <p>The watercourse has retained a similar plan form since 1892, though there has been some localised straightening and culverting of the watercourse (namely following the construction of the A55).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p>

**3.27. WEPRE BROOK**



**Wepre Brook A55 reach**



**Wepre Brook Brookside reach**





**Wepre Brook, Northop Hall reach**

<b>Catchment area</b>	9.57km <sup>2</sup>
<b>Key hydraulic connections</b>	Wepre Brook has several tributaries, mostly from the south of the catchment. The Alltami Brook and New Inn Brook both connect to the Wepre Brook downstream of the study area.
<b>River Condition Score</b>	A55 reach: moderate; Brookside reach: fairly poor; Northrop Hall reach: fairly poor
<b>Catchment description</b>	The majority of the catchment is rural and agricultural. There are small settlements in the catchment (Northop, Northop Hall and Soughton). The A55 and Brookside run parallel to the Wepre Brook through the study reach.
<b>Study reach description</b>	At the A55 reach the channel is narrow (approximately 1m width and 0.3m water depth). Through Brookside and Northop Hall reaches the watercourse is wider (width up to 2m and water depth 0.2m).  The bed material is well mixed generally, with areas of both gravel-pebble mix and cobbles. Some areas of sand were observed overlaying armoured substrate in the A55 reach.  At the A55 reach, the left bank is short grass pasture for grazing whilst the right bank is plantation woodland and scrub. Through Brookside and

	<p>Northop Hall there are more mature trees on both banks. There are gabion baskets supporting the right bank through the Brookside reach. The riparian zone through the Northop Hall reach is more substantial than other reaches.</p> <p>Wepre Brook follows largely the same course as depicted on the 1<sup>st</sup> edition OS maps (1888).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>There are four locations where this watercourse is within the Newbuild Infrastructure Boundary. At the Brookside reach the watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open cut.</p> <p>The A55 reach of the Wepre Brook is no longer applicable to the assessment due to the relocation of Northop Hall AGI as part of Change Request 1, which includes the relocation of its outfall from this reach to Wepre Brook Tributary 1. The Northop Hall and Brookside reaches of Wepre Brook remains unchanged and valid.</p>

### 3.28. NORTHOP BROOK



<b>Catchment area</b>	0.98 km <sup>2</sup>
<b>Key hydraulic connections</b>	Northop Brook flows northwards and becomes the Lead Brook before joining the Dee.
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	<p>The catchment is predominantly rural with land used for pastoral and arable farming. The catchment is steep towards the Dee Estuary. The watercourse flows through agricultural land before entering a wooded gorge.</p> <p>There is an artificial lake/reservoir at the lower end of catchment, downstream of the surveyed reach, although this appears to have a limited backwater effect.</p>

<p><b>Study reach description</b></p>	<p>Channel width varies between 2m and 3m. Water depth is approximately 0.5m.</p> <p>Bed material composed primarily of sands and silt throughout surveyed reach. The riparian buffer zone is composed of scrub and shrubs with some mature trees and fallen trees.</p> <p>1<sup>st</sup> edition OS map (1888) shows minimal channel changes. The reservoir was also in-situ at this time too.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless (TRS-43) methods.</p>

**3.29.**

**NORTHOP BROOK TRIBUTARY 1 AND 2**



**Northop Brook Tributary 1**



**Northop Brook Tributary 2**

<b>Catchment area</b>	Both <1km <sup>2</sup>
<b>Key hydraulic connections</b>	Both tributaries join the Northop Brook which flows northwards and becomes the Lead Brook before joining the Dee.
<b>River Condition Score</b>	Not surveyed
<b>Catchment description</b>	The catchments of these tributaries are predominantly arable farmland.
<b>Study reach description</b>	Both watercourses flow along field boundaries. They both have a hedgerow on the right bank. The watercourses are likely ephemeral and their riparian zones are dominated by tilled land.
<b>Interaction with the DCO Proposed Development</b>	Both watercourse will be crossed by the Newbuild Carbon Dioxide Pipeline via open trench.

### 3.30. LITTLE LEAD BROOK



<b>Catchment area</b>	0.51 km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows northwards towards the Dee Estuary
<b>River Condition Score</b>	Moderate
<b>Catchment description</b>	A small catchment which is dominated by agriculture with no suburban areas. This is a steep catchment which slopes towards the Dee. There is a small on-line pond attenuating flow upstream of the study reach.
<b>Study reach description</b>	Channel bankfull width is approximately 1m throughout the survey reach. Water depth is very shallow (0.05m). Channel bed composed of gravels and pebbles, with significant areas of sands and silts present. The riparian zone on the right bank is an ancient

	<p>woodland comprising of mature trees and fallen trees. On the left bank the riparian zone is tilled land behind occasional trees on the bank top.</p> <p>Channel course unchanged since 1<sup>st</sup> edition OS maps, although online pond is relatively recent (post 1971).</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The watercourse will receive runoff from the Flint AGI. The watercourse will not be crossed by the Newbuild Carbon Dioxide Pipeline.</p>



### 3.31. NANT-Y-FFLINT



<b>Catchment area</b>	4.31 km <sup>2</sup>
<b>Key hydraulic connections</b>	The Nant-y-Fflint has several unnamed tributaries mostly from the south of the catchment which join the watercourse upstream of the DCO Proposed Development.
<b>River Condition Score</b>	Fairly Good
<b>Catchment description</b>	The catchment is relatively steep, with a confined floodplain in a wooded valley. The catchment is predominantly rural farmland (arable and pastoral, forestry) with small settlements in Pentre Halkyn and Halkyn.
<b>Study reach description</b>	Bankfull width varies between 10 and 15m, with the surveyed wetted channel approximately 5m in width. Water depth is relatively shallow, between 0.1 and 0.2m in the surveyed reach.  The channel river bed is characteristic of steeper typologies, with step pool systems composed of cobbles and boulders, mixed with gravel and

	<p>pebbles throughout surveyed reach. At the time of the survey, the riparian zone was comprised of wooded valley and was heavily vegetated.</p> <p>No significant areas of channel change recorded since 1<sup>st</sup> edition OS maps (1888)</p>
<b>Interaction with the DCO Proposed Development</b>	The watercourse will receive runoff from Cornist Lane BVS.

### 3.32. WEPRE BROOK TRIBUTARY 1

<b>Catchment area</b>	<0.5km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows in a southeast direction and joins Wepre Brook downstream of the A55.
<b>River Condition Score</b>	Fairly Poor
<b>Catchment description</b>	The catchment is mostly comprised of arable and horticultural land. The catchment's elevation ranges between approximately 91m to 123m AOD.
<b>Study reach description</b>	Wepre Brook Tributary 1 discharges from a culvert into a shallow trapezoidal ditch for approximately 100m through a field used for grazing. The ditch then flows along a hedgerow for approximately 200m before flowing through a culvert under the A55. On the day of the survey, the channel was wet but this was likely due to prolonged rainfall which preceded the survey. It is likely that this channel is dry in summer months.
<b>Interaction with the DCO Proposed Development</b>	The relocation of Northop Hall AGI (PS03) will result in the AGI drainage to discharge to Wepre Brook Tributary 1.

### 3.33. GOLDFINCH MEADOW DRAIN

<b>Catchment area</b>	<0.5km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows northwards and connects to West Central Drain.
<b>River Condition Score</b>	The watercourse is in a culvert within the Newbuild Infrastructure Boundary therefore it is assigned Poor condition
<b>Catchment description</b>	The catchment is mostly comprised of arable and horticultural land with some areas of woodland, marshes, industrial and residential land use. The catchment's elevation ranges between approximately 3m to 36m AOD.
<b>Study reach description</b>	Goldfinch Meadow Drain flows through a culvert beneath Grinsome Road. Based on aerial imagery, Goldfinch Meadow Drain is choked with vegetation at the point where it enters the culvert beneath Grinsome Road and downstream of the culvert.
<b>Interaction with the DCO Proposed Development</b>	The extension of the Newbuild Infrastructure Boundary to enable access to Ince AGI from the adopted highway (PS06) includes a small section of the Goldfinch Meadow Drain which flows through a culvert beneath Grinsome Road.

### 3.34. MARSH LANE DRAIN

<b>Catchment area</b>	<0.5km <sup>2</sup>
<b>Key hydraulic connections</b>	This watercourse flows into Goldfinch Meadow Drain
<b>River Condition Score</b>	The watercourse is in a culvert within the Newbuild Infrastructure Boundary therefore it is assigned Poor condition
<b>Catchment description</b>	The catchment is mostly comprised of arable and horticultural land with some areas of woodland, marshes, industrial and residential land use. The catchment's elevation ranges between approximately 3m to 36m AOD.
<b>Study reach description</b>	Marsh Lane Drain flows through a culvert beneath Grinsome Road. Downstream of the culvert on Grinsome Road, Marsh Lane Drain enters a pond before discharging to Goldfinch Meadow Drain.

<b>Interaction with the DCO Proposed Development</b>	The extension of the Newbuild Infrastructure Boundary to enable access to Ince AGI from the adopted highway (PS06) includes a small section of the Marsh Lane Drain which flows through a culvert beneath Grinsome Road.
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## 4. CANALS

### 4.1. SHROPSHIRE UNION CANAL



<b>Catchment area</b>	n/a (artificial canal system)
<b>Key hydraulic connections</b>	The canal joins the Manchester Ship Canal to the River Dee at Chester.
<b>River Condition Score</b>	Fairly poor
<b>Catchment description</b>	<p>Artificial channel built in the late 18<sup>th</sup> century for industry and trade. Ellesmere and Chester canal branches. 16 locks separate Manchester Ship Canal from River Dee, whilst a series of locks and weirs control water level throughout the canal system.</p> <p>The surrounding land use is rural (farmland, arable and pastoral), woodland, urban, industrial and recreational (golf courses, etc).</p>

<p><b>Study reach description</b></p>	<p>Width uniformly 10m across, depth approximately 1.5m, with the canal level being higher than adjacent ground level.</p> <p>Canal bed is composed of silts. Within the riparian zone, there is sheet piling on both banks, with a towpath on the right bank.</p> <p>Additional branches of canal added throughout the early 19<sup>th</sup> century, completed in 1835.</p>
<p><b>Interaction with the DCO Proposed Development</b></p>	<p>The canal will be crossed by the Newbuild Carbon Dioxide Pipeline via trenchless (TRS-17) methods.</p>

## 4.2. MANCHESTER SHIP CANAL



<b>Catchment area</b>	n/a (artificial canal)
<b>Key hydraulic connections</b>	River Irwell; River Irk; River Medlock
<b>River Condition Score</b>	Not surveyed
<b>Catchment description</b>	Major artificial canal, extensively used for shipping and trade. There are multiple locks and sluices to maintain water levels within the channel.
<b>Study reach description</b>	<p>The canal varies between 14 – 24m in width, and up to 9m in depth. The bed of the canal is likely to be silt and mud substrate.</p> <p>The riparian zone includes a tow path and other urban infrastructure, as well as recreational rural areas (fields, trees in country parks, golf courses etc).</p>

	Channel construction in the late 19 <sup>th</sup> century, no changes to course in intervening years.
<b>Interaction with the DCO Proposed Development</b>	The Manchester Ship Canal is not within the Newbuild Infrastructure Boundary. Water from Ince Marshes is pumped into the canal during peak flows and therefore is a downstream receptor of activities within Ince Marshes.