

ENVIRONMENTAL STATEMENT (VOLUME III)

Appendix 11.1 Phase 1 Preliminary Assessment (Baseline Report)

HyNet Carbon Dioxide Pipeline DCO

Planning Act 2008

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

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1. INTRODUCTION

- 1.1.1. WSP UK Limited (WSP) was instructed by Liverpool Bay CCS Limited (the Applicant) to undertake a desk-based Phase I Preliminary Risk Assessment (Baseline Report).
- 1.1.2. This was originally produced as a standalone report (version 1) in December 2021 (ref: WSP (2021) Phase 1 Land and Soil Contaminated Land (Baseline Report), Ref: 70070865, dated: December 2021).
- 1.1.3. The original version of the report was issued to the Local Authority Contaminated Land Officers at Flintshire County Council (FCC) and Cheshire West and Chester (CWAC). The information herein comprised version 2 of the report and included reference to contemporary information not available at the time of writing version 1.

1.2. DCO PROPOSED DEVELOPMENT

- 1.2.1. The Newbuild Infrastructure Boundary comprises a linear area of approximately 35.7km and ten irregular shaped parcels of land, housing the proposed Above Ground Installations (four in total) and Block Valve Stations (six in total).
- 1.2.2. The Newbuild Infrastructure Boundary has been divided into seven sections (Section 1 to Section 6) from Ince in the east to Flint in the west and three Block Valves Stations (Section 7). The approximate extents of each section are set out below and presented on **Figure 11.1.1 (sheets 1 to 7), Annex A**. The irregular parcels of land for the Above Ground Installations and Block Valve Stations are also indicated on **Figure 11.1.1 (sheet 3), Annex A**.

1.3. AIMS AND OBJECTIVES

- 1.3.1. The primary purpose of this report is to set out the existing land and soil related environmental baseline conditions against which the DCO Proposed Development can be measured and environmental impacts quantified.
- 1.3.2. The specific objectives of this report in relation to the DCO Proposed Development:
 - Collation of available information on soil, geology (including potential mineral resources) hydrology and hydrogeology to establish the environmental sensitivity with regards to human health, controlled waters and the built environment.
 - Identification and assessment of potential soil and groundwater contamination related risks associated with the DCO Proposed Development.

- Identification of any land resources (agricultural land or mineral resources) that could be impacted during the construction or operation.
- Identification and assessment of potential ground stability related constraints.

1.4. PROJECT SCOPE

1.4.1. The following scope of works was undertaken to meet the aims and objectives of this assessment:

- A review of existing information available.
- Public record database review (DCO Proposed Development Groundsure Enviro Insight and Geo Insight reports).
- Review of contemporary and historical Ordnance Survey maps (provided with the Groundsure Insight reports).
- Consultation with stakeholders (Cheshire West and Chester Council and Flintshire County Council).
- Completion of a targeted walkover (on 29 November 2021).
- Review of geological, soil resources (including agricultural land), mineral resources, hydrogeological and hydrological maps.
- Preliminary assessment of unexploded ordnance (UXO).
- Completion of a preliminary environmental risk assessment including derivation of a preliminary Conceptual Site Model (CSM).
- Provision of a commentary relating to outline potential ground engineering and soil resource constraints.

1.5. THIRD PARTY SOURCES OF INFORMATION

- 1.5.1. Reporting of DCO Proposed Development information covering underlying ground conditions (superficial and bedrock deposits), hydrogeology, hydrology, history etc. Groundsure Enviro Insight and Geo Insight Reports (hereafter referred to as the Groundsure Report) and Groundsure Insight Historical Ordnance Survey mapping, dated July – August 2021, are included in Annex B.
- 1.5.2. N.B. It should be noted that the Newbuild Infrastructure Boundary for the DCO Proposed Development has been modified since Groundsure were commissioned to prepare the reports and maps. As such, the Newbuild Infrastructure Boundary shown within Annex B differs from the current boundary. Assessments in this Version 2 of the Phase 1 Land and Soil Baseline Report relate to the most up to date Boundary.
- 1.5.3. An Unexploded Ordnance (UXO) Desk Study and Risk Assessment for the DCO Proposed Development and its immediate surrounding area to address

potential for UXO and hazard. Zetica UXO Desk Study and Risk Assessment, dated 15 October 2021, included in **Annex C**.

N.B. The Newbuild Infrastructure Boundary for the DCO Proposed Development has been modified since the UXO Desk Study and Risk Assessment were prepared by Zetica. The Applicant will acquire an updated report once the Newbuild Infrastructure Pipeline Route has been confirmed. It is noted the overall conclusions and recommendations will likely remain unchanged following this update.

1. Online mapping tool which presents underlying ground conditions (superficial and bedrock) [REDACTED]. (Ref. 13.1).
2. Online mapping tool which presents underlying ground conditions in relation to coal outcrops and related mining hazards (e.g., mine entries, mine workings etc). Coal Authority Interactive Map viewer [REDACTED]. (Ref. 13.2)
3. Mapping of underlying ground conditions (superficial and bedrock). Geological Survey of England and Wales:
 - BGS 1:50,000 Series Map Sheet 97 Runcorn Drift Edition, dated 1977
 - BGS 1:50,000 Series Map Sheet 97 Runcorn Solid Edition, dated 1980
 - BGS 1:50,000 Series Map Sheet 108 Flint Solid Edition, dated 1999
 - BGS 1:50,000 Series Map Sheet 108 Flint Solid and Drift Edition, dated 1999
4. Online mapping tool which presents information on underlying water environment. Department for Environment Food & Rural Affairs (DEFRA); Environment Agency Catchment Data Explorer <https://environment.data.gov.uk/catchment-planning>. (Ref. 13.3)
5. Online mapping tool which presents detailed information covering aquifer designation, land-based designations (e.g., local nature reserves Ramsar sites etc) etc. Department for Environment Food & Rural Affairs (DEFRA) Magic Maps <https://magic.defra.gov.uk/MagicMap.aspx>. (Ref. 13.4)
6. Online mapping tool which presents river waterbody catchments, Source Protection Zones (SPZs), predictive Agricultural Land Classification (ALC) etc. Natural Resource Wales Data Map https://datamap.gov.wales/maps/new?layer=inspire-wg:wg_predictive_alc2. (Ref. 13.5)
7. Design manual which sets out the requirements for assessing and reporting the effects of highway projects on geology and soils. DMRB LA 109 Geology and Soils, dated October 2019

1.6. SOURCES OF INFORMATION - EXISTING REPORTS

1.6.1. The following reports have been produced for the DCO Proposed Development and have been used to inform this Phase I Baseline Report:

- **Appendix 1-1 - EIA Scoping Report (Volume III);**
- EniProgetti (2021) *Geological Desktop Study*, Document number: 1025H0BLRV80010, Dated 7th July 2021 (referred to as EniProgetti desktop); included as **Annex D**;
- **Appendix 11-3 - Mineral Resource Assessment (Volume III)**, referred to as MRA;
- **Appendix 11-4 - Agricultural Land Classification and Soil Resources (Section 1-6) (Volume III);**
- **Appendix 11-5 - Agricultural Land Classification and Soil Resources (Section 7) (Volume III);**
- **Outline Soil Management Plan and Outline Peat Management Plan** (which form appendices to the **OCEMP**, Document reference: **D.6.5.4**).

1.7. APPROACH TO CONTAMINATED LAND ASSESSMENT

1.7.1. The potential risks from contamination within soil and groundwater are assessed according to the environmental setting / ground model, likely presence of potential sources of contamination and the proposed use of the DCO Proposed Development.

1.7.2. The source-pathway-receptor model forms the basis of the risk assessment; potential risks are only considered to exist if there is a credible source (e.g., a chemical substance capable of causing harm); a pathway for migration of the source to the receptor; and a sensitive receptor that could be affected (e.g., nearby river or site users). A source-pathway-receptor contaminant linkage assessment is termed a conceptual model (CM). A preliminary CM is produced prior to intrusive ground investigation and is refined following collection of DCO Proposed Development specific data (if appropriate).

1.7.3. As per **Appendix 1.1 - EIA Scoping Report, (Volume III)** the following criteria / buffer zones have been adopted upon identification of potential source of contamination:

- A 50m buffer from proposed pipeline route (i.e., Newbuild Infrastructure Scoping Boundary) has been utilised in identifying sources of contamination posing a risk to human health receptors; and

- A 250m buffer from the proposed pipeline route has been utilised to identify sources of contamination posing a risk to sensitive controlled waters receptors.

1.7.4. The above receptor boundaries were selected to comply with the study areas recommended in DMRB LA 109 Geology and Soils (**Ref. 13.6**) which recommended the following:

- The construction footprint / project boundary (including compounds and temporary land take) (50m considered to be appropriate).
- The location of contamination outside the project boundary / footprint that have the potential to migrate within the Newbuild Infrastructure Boundary and effect receptors (250m considered to be appropriate).
- The location of sensitive receptors outside the Newbuild Infrastructure Boundary (i.e., designated sites) that can be affected by the project, i.e., by re-mobilisation or introduction of contaminants (250m considered to be appropriate).

1.7.5. The potential presence of best and most versatile (BMV) agricultural land and potential mineral resource is assessed to determine the potential loss or sterilisation of either.

1.7.6. It is important to recognise that any risks identified during a preliminary assessment are perceived risks based on the recorded information reviewed. A more detailed assessment would require intrusive investigation. The preliminary assessments presented herein are qualitative based on professional judgements following review of the available data and within the context of the existing/proposed use. Those risk categories presented follow guidance presented in *CIRIA Publication C552, Contaminated Land Risk Assessment – A Guide to Good Practice*. A copy of CIRIA C552 risk appraisals methodology is presented in **Annex F**.

1.8. **APPROACH TO SOIL RESOURCE ASSESSMENT**

AGRICULTURAL LAND

1.8.1. In order to assess the potential impact to soil resources the post 1988 agricultural soil classification grades will be reviewed. The grading is classified according to the now defunct Ministry of Agriculture Fisheries and Food (MAFF) guidelines as follows:

- Grade 1: Excellent Quality with no limitations to agricultural use.
- Grade 2: Very good quality with minor limitations to agricultural use.
- Grade 3a: Good quality that can produce moderate to high yields of limited crops.

- Grade 3b: Moderate quality that can produce moderate yields of limited crops.
- Grade 4: Poor quality that significantly restricts the range or yield of crops.
- Grade 5: Very poor quality with severe restrictions, generally used for pasture or rough grazing.

1.8.2. The National Planning Policy Framework (NPPF) and Planning Policy Wales defines Grades 1, 2 and 3a as BMV land. LA109 (see WSP Scoping for relevant legislation) (**Ref. 13.6**) defines the sensitivity as follows:

- Very High: Grades 1 and 2
- High: Grade 3a
- Medium: Grade 3b
- Low: Grade 4 and 5

MINERAL RESOURCES

1.8.3. In order to establish if potential mineral resources could be compromised during the construction and / or operation of the DCO Proposed Development the BGS Mineral Resources maps has been assessed to ascertain if any mapped Mineral Resource lies within the Newbuild Infrastructure Boundary.

2. SECTION 1

2.1. DESCRIPTION AND CURRENT USE

2.1.1. An overview of Section 1 can be seen on **Figure 11.1.2 (sheet 1), Annex A** and pertinent details are summarised in **Table 2.1**.

Table 2.1 - Description of Section 1

Location (Start and End Point)	Start: Ince at land south of CF Fertilisers CH2 4LB, End: Stanlow Manufacturing Complex, CH2 4HU
Length	Approximately 3.8km
National Grid Reference of Start and End Point:	Start: 346911 , 376135 , End: 344498 , 374757
Current Land Use	<p>This Section predominantly comprises agricultural fields. Industrial land occupied by Stanlow Manufacturing Complex is located in the northwest and a CF Fertilisers Plant and Ince Bio Power Station is located in the northeast.</p> <p>Other notable features include those associated with Chester Services positioned centrally, New Dairy Farm (located to the east of Chester Services) and a farming compound off Old Cryers Lane in the west.</p>
Surrounding Area	<p>Pertinent surrounding land use:</p> <ul style="list-style-type: none">• Industrial land use (Essar Stanlow Manufacturing Complex to the northwest and CF Fertilisers to the northeast). A walkover of land adjacent to CF Fertilisers included as Area 1 in Annex I.• Agricultural land and farm buildings / yards to the south• Railways – Northern Rail running between Helsby (east) and Ince and Elton Station (west) and unnamed industrial railway lines at Stanlow Oil Refinery.• Major highways (A5117 and M56)• Waterways (Gale Brook (a tributary of the River Gowy), West Central Drain, East Central Drain and Hornsmill Brook)• Residential land use (within the suburb of Elton to the north).
Elevation and Topography	The land is roughly undulating and starts at 6 metres above ordnance datum (m AOD), rising to 25m AOD near the M56 and dropping to approximately 13m AOD at Stanlow.

2.2. LAND USE HISTORY

2.2.1. A summary of Section 1 pertinent features noted from a review of historical maps (Groundsure historical maps in **Annex B**) is presented in **Table 2.2**.

Table 2.2 - Pertinent History for Section 1

Mapping Dates	Proposed Development Section and Immediate Surroundings (approximately 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
1890s to 1900s	<p>Earliest available mapping shows land generally comprises undeveloped agricultural / marsh land intersected by features such as ponds, footpaths, roads and unnamed streams / drains. A quarry is shown in the western limits of the section, north of Cryers Farm and within 230m of the proposed pipeline.</p> <p>Elton Brook (flowing northwest) is located in the southwest of the section (culverted beneath the existing Cryers Lane) and positioned immediately adjacent to the proposed pipeline for much of its length, before being intercepted at the A5117.</p> <p>The London and North-west Great Western Joint Railway (L. & N.W & G.W.J.R) appears intersecting the northernmost extent from 1897 onwards.</p>	<p>The wider area comprises undeveloped agricultural land and / or small farming compounds (e.g., Grinsome Farm), intersected by infrastructure and surface water features including unnamed ponds and drainage channels of the Weaver Gowy Catchment.</p> <p>Embankments surrounding the Manchester Ship Canal are located approximately 1km north and Hoolpool Gutter which feeds into the Hornsmill Brook is located approximately 650m east.</p> <p>Nearest residential land use is presented approximately 500m west at Thornton le Moors and 790m north at Elton from 1897 onwards.</p>
1900 to 1960s	<p>In 1938 the A5117 is constructed and crosses the section east to west towards the southern extents. Generally, the pipeline falls between 200 - 500m south of the A5117, however at the western limit of the section, the proposed pipeline passes under the carriageway.</p> <p>No further significant changes are observed.</p> <p>According to the Groundsure Report in Annex B, following World War II (WWII), the central portion was used for storage and distribution of explosives.</p>	<p>Expansion of the surrounding towns including Elton Green and Elton, located from 500m north, and Ince and Hapsford located 1km north and east of the DCO Proposed Development.</p> <p>No further significant changes are observed.</p>
1960s to 1990s	<p>Between 1967 and 1968, a large development (present day Stanlow Manufacturing Complex) is constructed. The development includes multiple buildings and cylindrical tanks and is labelled as a 'Works'. New sections of railway line, identified as 'Mineral Railway' are constructed, 200m north and west of the proposed pipeline (closest point) connecting the 'Works' to the existing London and North-west Great Western Joint Railway. In addition, new roadways and structures appear immediately adjacent to the proposed pipeline and Stanlow AGI, at the western limits of the section.</p> <p>Between 1968 and 1990, the London and North-west Great Western Joint Railway expands towards the northern extents of the section and 220m west of the proposed pipeline, to include a railyard / depot associated with the 'Works'. In addition, 'Perimeter Road' is constructed along the northern boundary of the depot and within the defined Newbuild Infrastructure Boundary.</p> <p>A bungalow is identified in the southwest of the section (off the existing Cryers Lane) and 200m northeast of the proposed pipeline.</p> <p>According to the Groundsure Report in Annex B, the former military land was later used for food storage by the Ministry of Agriculture Fisheries and Food (MAFF) between 1957 and 1985, before being disposed of to the private sector in 1990.</p>	<p>The following features are noted east to west across the section between the 1960s to 1980s:</p> <p>From 1967, the surrounding area is encapsulated by the expanding Works (Stanlow Manufacturing Complex) with notable infrastructure including multiple cylindrical tanks and associated structures located within 250m of the DCO Proposed Development;</p> <p>Between 1967 and 2001 a garage and a moat, approximately 0.2ha in size, are shown, 400m and 260m north respectively, of the proposed pipeline at Elton Green;</p> <p>Between 1968 and 2010, a large area identified as a 'canal deposit dump' is located 1.3km northeast, adjacent to the Hoolpool Gutter;</p> <p>By 1983, the M56 located 200m south (closest point) is constructed with an adjacent council yard positioned along the A5117, south of Hapsford Interchange at Junction 14 (390m southeast of proposed pipeline).</p> <p>In 1983, an area of identified as a lake is presented in Hapsford (Moor Lane), 1km southeast. This area is subsequently identified as a 'quarry' on historical mapping dated 2001 and a historic landfill operated by Brock Plc for the disposal of 'Special Waste' within the Groundsure Report in Annex B.</p>
1990s to present day	<p>By 1990, the 'Works' is labelled as Oil Refinery (Stanlow Manufacturing Complex) and surrounding railway and road infrastructure expands. In contrast the railyard / depot for the London and North-west Great Western Joint Railway has been decommissioned and reverted to hard standing for heavy goods vehicle parking.</p>	<p>The following features are noted east to west across the section from 1990 mapping onwards:</p> <p>Between 1990 and 2010, a cooling tower is identified approximately 1km west of the proposed pipeline. In 2010, the cooling tower is no longer shown and the area has been developed into a large warehouse, occupied by Encirc Glass;</p>

Mapping Dates	Proposed Development Section and Immediate Surroundings (approximately 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
	<p>In 1990, an additional works with associated structures and infrastructure (numerous tanks and chimneys) is constructed to the immediate northeast of the section at the Ince Marshes (present day CF Fertiliser Site).</p> <p>2021 mapping presents Chester Services, located at Junction 14 of the M56 and within 50m of the proposed pipeline.</p> <p>No further significant changes are observed.</p>	<p>In 1990 a sewage works is located 470m southwest of the proposed pipeline, at the eastern limits of Stanlow Manufacturing Complex. The sewage works is not shown on maps from 2001 onwards.</p> <p>The Ince Bio Power Station, located 400m north and adjacent to the existing CF Fertilisers is not identified on most recent mapping, however available information indicates that the facility generated its first energy as part of testing in May 2018 and was fully operational by March 2019.</p>

2.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

- 2.3.1. An overview of the extent of Section 1 against BGS geological mapping and a summary of boreholes within this Section are presented in **Annex H**.
- 2.3.2. Made Ground is expected within the Newbuild Infrastructure Boundary and in the immediate surrounding area, associated with existing and historical development (identified in **Section 2.2**). BGS Mapping (**Ref. 13.1**) indicates that superficial deposits comprising Tidal Flat Deposits (clay, silt and sand) are recorded in the east and Glacial Till in the centre and west. These are further underlain by bedrock comprising the Kinnerton Sandstone in the east and Chester Formation in the centre and west.

HYDROGEOLOGY

- 2.3.3. The Environment Agency classifies the Tidal Flats deposits and the Glacial Till as a Secondary Undifferentiated Aquifer. The Kinnerton Sandstone and the Chester Formation are both classified as Principal Aquifer.
- 2.3.4. The section does not lie within, or within 250m of, a source protection zone (SPZ).

HYDROLOGY

- 2.3.5. A summary of the hydrology information for Section 1 is presented in **Table 2.3**, based on information contained within the Groundsure Report in **Annex B**.

Table 2.3 - Section 1 Hydrology

Catchment Areas	Features Identified <250 of proposed pipeline	Details
<p>Operational Catchment: Gowy</p> <p>Management Catchment: Weaver Gowy</p> <p>Water Body Catchment: Gowy (Milton Brook to Mersey) Water Body and Peckmill Brook, Hoolpool Gutter at Ince Marshes.</p>	<p>This section of Newbuild Carbon Dioxide Pipeline is noted to intersect Gale Brook (a tributary of the River Gowy), West Central Drain, East Central Drain and Hornsmill Brook</p> <p>Numerous ponds have also been identified within 250m of this section.</p>	<p>The River Gowy is a tributary of the River Mersey which is located approximately 3km north. The River Gowy located 1.4km west, has been classified with the following status' from the Environment Agency as of 2019 (most recent evaluation); ecological classification of moderate, physico-chemical quality elements of poor to high, high concentrations of zinc, manganese, copper and iron and fails for concentrations of mercury (and its compounds), Polybrominated diphenyl ethers (PBDE) and Perfluorooctane sulphonate (PFOS).</p> <p>The West Central Drain, East Central Drain and Hornsmill Brook fall into the catchment for Peckmill Brook, Hoolpool Gutter at Ince Marches. Peckmill Brook is a tributary to the River Mersey. The water body catchment has received the following status' from the Environment Agency as of 2019 (most recent evaluation); ecological classification of moderate, physico-chemical quality elements of poor to high, high concentrations of zinc and fails for concentrations of mercury (and its compounds) and Polybrominated diphenyl ethers (PBDE).</p>

COAL MINING

- 2.3.6. A review of the Coal Authority Interactive mapping online (**Ref. 13.2**) indicates that Section 1 is not within a Coal Mining Reporting Area. Coal mining related stability risks are therefore not considered further within this section assessment.

QUARRYING AND MINERAL EXTRACTION

- 2.3.7. A review of the Groundsure report, shown in **Annex B**, regarding quarrying and mineral extraction in Section 1 is summarised in **Table 2.4**.

Table 2.4 - Quarrying and Mineral Extraction

Feature	Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
Surface Ground Workings	As detailed briefly in Section 2.2 Land History, numerous surface ground working features have been identified within 100m of Section 1 including many ponds and few unspecified heaps.	As detailed briefly in Section 2.2 Land History, numerous surface ground working features have been identified within 250m of Section 1 including many ponds, a few unspecified pits (likely sand, gravel and clay pits based on underlying geology), a quarry (likely sandstone based on underlying geology) and cuttings at Junction 14 of the M56.
Historical Mineral Planning Areas	N/A	An area of sandstone surface mineral working is located on the outskirts of Hapsford, approximately 1km southeast.
Other	None of the following features have been identified within the Study Area / 500m / 1km (as defined) of Section 1; <ul style="list-style-type: none">• Natural Cavities (within 500m)• British Pits (within 500m)• Historical Underground Workings (within 500m)• Historical Non-coal Mining Activities (within 1km)• Mining Cavities (within 1km)• Coal, clay and tin mining (within the Newbuild Infrastructure Boundary)	

Feature	Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
	<ul style="list-style-type: none"> Gypsum and brine extraction areas (within the Newbuild Infrastructure Boundary) <p>The potential risk from the above features is therefore considered to be negligible.</p>	

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

- 2.3.8. A review of the BGS mapping (**Ref. 13.1**) indicates an area of sub-alluvial superficial deposits that are classed as a mineral resource within Section 1 located immediately south of Stanlow and underlying the agricultural fields south of Elton Green.

NATURAL GROUND SUBSIDENCE

- 2.3.9. A summary of subsidence risks within Section 1 are present in **Table 2.5**.

Table 2.5 - Summary of Natural Ground Subsidence

Hazard	Rating (Within 50m of Newbuild Carbon Dioxide Pipeline Route)
Shrink Swell Clays	Negligible - very low
Running Sands	Very low - moderate (moderate risk identified at eastern extents)
Compressible Deposits	Negligible - moderate - (high risk identified at eastern extents)
Collapsible Deposits	Negligible - very low
Landslides	Very low
Ground Dissolution of Soluble Rocks	Negligible

FLOODING

Surface Water Flooding

- 2.3.10. Following a review of flood risk mapping for planning, the majority of Section 1 (excluding the central portion adjacent to New Dairy Farm) has been identified within Flood Risk Zone 3, defined as “*Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding*”. Flood defences are present across the scheme across the north-eastern half of section 1.

Groundwater Flooding

- 2.3.11. The north-eastern half and south-western fringe of Section 1 is defined as being at high risk from groundwater flooding. The remaining area towards the centre and northwest is rated as moderate to high risk.

SENSITIVE LAND USES

- 2.3.12. Thornton le Moors (400m west of Section 1) is a designated conservation area.
- 2.3.13. No other sensitive environmental designations have been identified within 2km of Section 1 of the DCO Proposed Development.
- 2.3.14. The following sensitive land uses, all relating to the Mersey Estuary, located 2.2.km north (at its closest point) are recorded within 2.5km of Section 1:
- Three Sites of Special Scientific Interest (SSSIs);
 - One entry of a conserved wetland site (Ramsar site); and
 - One entry of a Special Protection Area (SPA).
- 2.3.15. In addition, Helsby Quarry (2.4km east of Section 1) is a Local Nature Reserve (LNR).

AGRICULTURAL LAND DESIGNATION

- 2.3.16. Section 1 is not fully mapped in terms of agricultural land designation on MAGIC maps (available online); however, the available designations indicate the Newbuild Infrastructure Boundary includes Grade 3a and 3b. The Agricultural Land Classification information contained within **Appendix 11-4 (Volume III)** indicates that Section 1 contains Grades 1-4. Grade 1 to Grade 3a is included in best and most versatile land and classified as high grade under LA 109 (**Ref. 13.6**) which grades the sensitivity of a receptor based on its environmental value.

SOIL TYPE

- 2.3.17. The expected soil types in Section 1 include Loamy and sandy soils in the east, with naturally high groundwater and a peaty surface, with low to high fertility and medium to high carbon. Loamy and clayey (slightly acid but base-rich) soils in the centre and west, which are slowly permeable (impeded drainage to stream network) and seasonally wet, with moderate fertility and low carbon.

IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- SECTION 1

- 2.3.18. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

- 2.3.19. A summary of sources identified within 250m of Section 1 of the proposed pipeline are presented in **Table 2.6** and a spatial plan is included as **Figure 11.1.3 (sheet1), Annex A**.

Table 2.6 - Section 1 Potential Sources of Contamination

Source	Contaminants
<p>Made Ground associated with identified land uses (bullet pointed below) or unexpected Made Ground at agricultural land.</p> <ul style="list-style-type: none"> Existing industrial / commercial land including Stanlow Refinery, CF Fertilisers and Chester Service Station. Historical military land. 	<p>Asbestos, heavy metals, polyaromatic hydrocarbons (PAHs) 16, total petroleum hydrocarbons criteria working group (TPH CWG), volatile organic substances (VOCs), semi-volatile organic substances (SVOCs) and phosphorous*</p> <p>* Information provided to WSP by Groundsure suggest that phosphor products were produced at the identified former military land.</p>
Made Ground associated with infilled ponds, pits and quarries.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Railway and highway land.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Polychlorinated biphenyls (PCBs) relating to spillages / leakages at offsite electrical substations (see Section 8).	Asbestos, polychlorinated bi-phenyls (PCBs) heavy metals, PAH 16 and TPH CWG.
Free-phase contamination within groundwater relating to existing and historic industrial / commercial land use.	TPH CWG / VOCs / SVOCs
Hazardous gases associated with infilled land, Made Ground and historic landfill operations (more information on landfills is provided during the later Regulatory Information section).	Carbon dioxide, methane and hydrogen sulphide
Hazardous vapours from groundwater impact related to existing and historic industrial / commercial land use.	TPH / VOC vapours and carbon dioxide and methane

PATHWAYS

- Direct contact, ingestion or inhalation of fibres or vapours;
- Inhalation of hazardous gases or vapours;

- Accumulation of hazardous gases or vapours (asphyxiation and explosive risk);
- Overland flow of groundwater;
- Lateral migration via unnamed streams and watercourses;
- Leaching of contaminants via the unsaturated zone into shallow groundwater;
- Vertical migration into superficial and bedrock aquifers; and
- Baseflow of groundwater to surface water features.

RECEPTORS

Human Health

- Ground workers during the construction/ decommissioning phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e., dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;
- Deeper groundwater within bedrock;
- Water abstractions within 250m (see Section 8); and
- Nearby named and unnamed surface watercourses and streams.

Environmentally Sensitive Sites

- Flora and fauna within the nearby designated sites.

Mineral Resources

- Identified sub-alluvial superficial mineral resources, immediately south of Stanlow and underlying the agricultural fields south of Elton Green.

The Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

3. SECTION 2

3.1. DESCRIPTION AND CURRENT USE

- 3.1.1. An overview of Section 2 can be seen on **Figure 11.1.2 (sheet 2), Annex A** and pertinent details are summarised in **Table 3.1**.

Table 3.1 - Description of Section 2

Location (Start and End Point)	Start: Stanlow Manufacturing Complex, CH2 4HU, End: South-bound carriageway of the A41 Liverpool Road (approximately 0.75km north-west of Chester Zoo)
Length	Approximately 7.78km
National Grid Reference of Start and End Point:	Start: 344498, 374757, End: 339953, 371093
Current Land Use	Section 2 predominantly passes through agricultural land and is intercepted by various carriageways, waterways and paths.
Surrounding Area	<p>Prominent surrounding land use:</p> <ul style="list-style-type: none">• Industrial land use at the proposed Stanlow AGI, to the south of Stanlow Manufacturing Complex;• Agricultural land and numerous isolated farm buildings / yards (Collinge Farm, Woodside Farm, Ashwood House Farm etc.);• Former Thornton Green Landfill and Spring Bank Farm Landfill (visited during walkover and identified as Area 2 and Area 3 in Annex I) and Gowy Landfill Site (approximately 150m south / southeast at closest point) (visited during walkover and identified as Areas 4A and 4B in Annex I); and• Industrial land use at Government Pipelines and Storage System (GPSS) Backford South (approximately 50m north from proposed pipeline route at closest point);• Major highways (M56, M53 and A41);• Railway (Birkenhead to Chester Railway Line);• A Ministry of Defence (MOD) fuelling depot;• Waterways: River Gowy and Shropshire Union Canal; and

	<ul style="list-style-type: none"> Residential land use within small nearby villages / parishes (Thornton le Moors, Wervin, Caughall, Chorlton and Backford).
Elevation and Topography	Elevation ranges between 10mAOD to 30mAOD. Ground levels across much of the section gently fluctuate between 10 and 20mAOD but may increase up to between 20 and 30mAOD to the west of the Shropshire Union Canal.

3.2. LAND USE HISTORY

3.2.1. A summary of Section 2 pertinent features noted from a review of historical maps (Groundsure historical maps in **Annex B**) is presented in **Table 3.2**.

Table 3.2 - Pertinent History for Section 2

Mapping Dates	Proposed Development Section and Immediate Surroundings (approximately – 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
1890s to 1930s	<p>Earliest available mapping shows land generally comprises undeveloped agricultural land intersected by small pockets occupied by residential properties and farmland, surface water features (River Gowy, Shropshire Union Canal and numerous ponds) and highway infrastructure (carriageways and pathways).</p> <p>In addition, two surface workings have been identified in Backford and within 100m of the proposed pipeline; Chorlton Quarry; sandstone quarry identified within 50m of the proposed Pipeline, located 200m west of the Shropshire Union Canal between 1898 to 1967; and</p> <p>Church Farm Sand Pit; surface working identified approximately 100m north of the proposed pipeline and west of the A41 Liverpool Road between 1898 to 1968.</p>	<p>In the wider area the majority of development is concentrated around Thornton le Moors, Croughton, Picton and Wervin where land use is predominantly residential and agricultural. The Birkenhead to Chester Railway Line is located 1km west of the section and is orientated northwest to southeast. In addition, land to the northeast of Picton and surrounding the River Gowy is labelled as 'Liable to Flooding' on maps dated 1908.</p>
1930 to 1950s	<p>Few changes identified including;</p> <p>The construction of the A5117 carriageway in 1938, orientated northeast to southwest and within 50m of the Newbuild Carbon Dioxide Pipeline to the north of Thornton le Moors; and</p> <p>Realignment of the River Gowy west of Wimbolds Trafford in 1954.</p>	<p>No significant changes or features identified within the surrounding area.</p>
1960s to 1980s	<p>Very few significant changes within the immediate vicinity of Section 2 are noted:</p> <p>Construction of GPSS Backford South between 200 to 250m north of the proposed pipeline, in Backford. Identified as 'depot' on historical maps dated between 1967 to 2001;</p> <p>Extensive industrial development at Stanlow Manufacturing Complex from 1967 onwards including the construction of a mineral railway, to the north of Thornton le Moors;</p> <p>Construction of the M56 between 1978 and 1983 which intersects the section southeast to northwest, located to the south of Thornton le Moors; and</p> <p>Construction of the M53 by 1983 which intersects the section north to south, located to the south of Wervin.</p>	<p>The following key features have been identified (east to west):</p> <p>The former smithy (circa 1908 to 1964) located 200m south of the Newbuild Infrastructure Boundary in Picton, is labelled as a slaughter house on 1967 to 1968 mapping; and</p> <p>Chester Zoo is constructed by 1967 and is located 600m south of the proposed pipeline at Caughall.</p>
1990s to present day	<p>Two historical landfill sites have been identified within the Groundsure Report to the east of Section 2 at Thornton Green and within 100m of the proposed pipeline;</p> <p>Thornton Green Landfill; inert landfill, active between 1983 to 1985; and</p> <p>Spring Bank Farm Landfill; inert landfill, active between 1990 and 1992.</p> <p>Historical maps between 1983 to 2001 are unavailable. Both historic landfills were visited as part of the reconnaissance and have been surveyed to contain arable / pastureland at present (identified as Area 2 and Area 3 in Annex I).</p> <p>In addition, the Gowy Landfill located approximately 150m south / southeast (at closest point) is not identified on historical maps, however, according to publicly available information, has been operating since 1987. Again, this landfill was visited as part of the reconnaissance and was surveyed to be active landfill (identified as Areas 4A and 4B in Annex I).</p>	<p>No significant changes or features identified within the surrounding area.</p>

3.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

- 3.3.1. An overview of the extent of Section 2 against geological mapping and a summary of boreholes within this Section are presented in **Annex H**.
- 3.3.2. Made Ground is expected within the Newbuild Infrastructure Boundary and in the immediate surrounding area, associated with existing and historical development (identified in Section 3.2). BGS Mapping (**Ref. 13.1**) identifies the following superficial deposits along Section 2; Glacial Till, Blown Sand, Tidal Flat Deposits, Glaciofluvial Deposits, Alluvium and Peat. These are further underlain by bedrock comprising the Chester Formation with a small section of the proposed pipeline encroaching the Wilmslow Sandstone to the north.

HYDROGEOLOGY

- 3.3.3. The Environment Agency classifies the Tidal Flats Deposits and the Glacial Till as a Secondary Undifferentiated Aquifer, the Blown Sand, Alluvium and Glaciofluvial deposits as a Secondary A Aquifer and the Peat as Unproductive Strata. The Chester Formation and Wilmslow Sandstone are both classified as Principal Aquifer.
- 3.3.4. The Section does not lie within, or within 250m of, a source protection zone (SPZ).

HYDROLOGY

- 3.3.5. A summary of the hydrology information for Section 2 is presented in **Table 3.3**, based on information contained within the Groundsure Report in **Annex B**.

Table 3.3 - Section 2 Hydrology Summary

Catchment Areas	Features Identified <250m of proposed pipeline	Details
<p>Operational Catchment: Gowy</p> <p>Management Catchment: Weaver Gowy and North West AWB Management Catchment</p> <p>Water Body Catchment: Gowy (Milton Brook to Mersey), Stanney Mill Brook and Weaver Upper Canals</p>	<p>This Section intersects several unnamed streams, the River Gowy, Mill Brook and the Shropshire Union Canal.</p> <p>Numerous ponds have also been identified within 250m of this section.</p>	<p>The unnamed streams are mainly at the eastern end of the section and comprise drains within agricultural fields immediately north of the Gowy Landfill.</p> <p>Mill Brook, located within the Stanney Mill Brook Water Body Catchment, has been classified with the following status' from the EA as of 2019 (most recent evaluation); ecological classification of moderate, physico-chemical quality elements of bad to high, high concentrations of copper, iron, manganese triclosan and zinc and fails for concentrations of Benzo(g-h-i)perylene, mercury (and its compounds) and Polybrominated diphenyl ethers (PBDE). According to historical maps, Mill Brook flows in a northerly direction. A confluence with the River Gowy is also identified east of Ellesmere Port.</p> <p>The Shropshire Union Canal connects Chester to the south with Ellesmere Port to the north. The Shropshire Union Canal Water Body has been classified with the following status' from the EA as of 2019 (most recent evaluation); ecological classification of moderate, physico-chemical quality elements of high and fails for concentrations of mercury (and its compounds) and Polybrominated diphenyl ethers (PBDE).</p>

COAL MINING

- 3.3.6. A review of the Coal Authority Interactive mapping online (**Ref. 13.2**) indicates that Section 2 is not within a Coal Mining Reporting Area. Coal mining related stability risks are therefore not considered further within this Section assessment.

QUARRYING AND MINERAL EXTRACTION

- 3.3.7. A review of the Groundsure report regarding quarrying and mineral extraction in Section 2 is summarised in **Table 3.4**.

Table 3.4 - Summary of Quarrying and Mineral Extraction in Section 2

Feature	Pipeline Section and Immediate Surroundings (approximately 100m Buffer)	Wider Surroundings (approximately 250m Buffer)
Surface Ground Workings	As detailed briefly in Section 3.2 Land History, numerous surface ground working features have been identified within 100m of Section 2 largely relating to ponds, but also the Shropshire Union Canal and cuttings along the M53 and M56 carriageways.	As detailed briefly in Section 3.2 Land History, numerous surface ground working features have been identified within 250m of Section 2, again largely relating to ponds, but also the Shropshire Union Canal, cuttings along the Birkenhead to Chester Railway Line, refuse and unidentified heaps at GPSS Backford South and offsite surface working sites including Chorlton Quarry and Church Farm Sand Pit in Backford.
Historical Mineral Planning Areas	<p>The BGS Mineral Resources map of Cheshire identifies Church Farm Sand Pit (described above) as a surface planning permission area (valid and expired) for sand and gravel.</p> <p>In addition, the mapping also labels another surface planning permission area (valid and expired) for sandstone extraction within</p>	<p>No historical mineral planning areas have been identified between 100 - 250m of the Newbuild Carbon Dioxide Pipeline.</p> <p>The Groundsure Report in Annex B identifies a historic surface mineral working for sand and gravel (ongoing planning application status) in Backford, located 600m north of the proposed pipeline and adjacent to the A41 Liverpool Road. N.B</p>

Feature	Pipeline Section and Immediate Surroundings (approximately 100m Buffer)	Wider Surroundings (approximately 250m Buffer)
	<p>100m of the proposed pipeline (at closest point) at Thornton Green Farm, Thornton-le-Moor. N.B available historical maps do not identify this feature.</p> <p>The Groundsure Report in Annex B also identifies a historic surface mineral working for sand (withdrawn planning status) at Collinge Farm, located within 100m of the Newbuild Infrastructure Pipeline (at closest point) in Backford. N.B again, available historical maps do not identify this feature.</p>	the Backford sand and gravel pit is not shown on available historical maps.
Other	<p>None of the following features have been identified within the Study Area / 500m / 1km (as defined) of Section 2;</p> <ul style="list-style-type: none"> • Natural Cavities (within 500m) • British Pits (within 500m) • Historical Underground Workings (within 1km) • Historical Non-coal Mining Activities (within 1km) • Mining Cavities (within 1km) • Coal, clay and tin mining (within the Newbuild Infrastructure Boundary) • Gypsum and brine extraction areas (within the Newbuild Infrastructure Boundary) <p>The potential risk from the above features is therefore considered to be negligible.</p>	

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

- 3.3.8. A review of the BGS mapping (**Ref. 13.1**) identifies the following superficial mineral resources along Section 2; sub-alluvial deposits, glaciofluvial deposits, peat and blown sand deposits.

NATURAL GROUND SUBSIDENCE

3.3.9. A summary of subsidence risks within Section 2 are present in **Table 3.5**.

Table 3.5 - Summary of Natural Ground Subsidence

Hazard	Rating (Within 50m of Pipeline Route)
Shrink Swell Clays	Negligible - very low
Running Sands	Very low - moderate (moderate risk identified at western extents of section 2)
Compressible Deposits	Negligible - high (moderate risk identified for the tidal flat deposits along the Shropshire Union Canal and high risk identified for the peat deposits at the Gowy Landfill site).
Collapsible Deposits	Negligible - very low
Landslides	Very low - low
Ground Dissolution of Soluble Rocks	Negligible

FLOODING

Surface Water Flooding

3.3.10. Following a review of flood risk mapping for planning, the land adjacent to the Shropshire Union Canal (western extent of section 2) and River Gowy (west of B5132 Ince Lane and east of Picton Lane) has been identified within Flood Risk Zone 3, defined as “*Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding*”.

Groundwater Flooding

3.3.11. The western extents of Section 2 are defined as having low to moderate risk from groundwater flooding, with risk increasing towards the Shropshire Union Canal. Moving eastwards, land in the centre of Section 2 is classified as having a low risk, however towards Picton, the risk increases to moderate and then to high within proximity of the River Gowy. To the east of the River Gowy at Thornton Green and up to Thornton-le-Moors, groundwater flooding risk generally decreases again to moderate.

SENSITIVE LAND USES

- 3.3.12. No sensitive environmental designations have been identified within 2km of Section 2 of the DCO Proposed Development.

AGRICULTURAL LAND DESIGNATION

- 3.3.13. Section 2 is not mapped in terms of agricultural land designation on MAGIC maps (**Ref. 13.4**). The Agricultural Land Classification information contained within **Appendix 11-4 (Volume III)** indicates that Section 2 contains a mixture of Grades 1 - 5.

SOIL TYPE

- 3.3.14. The expected soil types in Section 2 include;
- Loamy and clayey (slightly acid but base-rich) soils across the majority of section 2 which are slowly permeable (impeded drainage to stream network) and seasonally wet, with moderate to high fertility and low carbon.
 - Fen peat soils in the centre at the Gowy Landfill, with naturally high groundwater, mixed fertility and medium to high carbon.
 - Sandy (slightly acid) soils in the west exclusively (relating to the glaciofluvial deposits), which are freely draining with low fertility and carbon.

3.4. IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- SECTION 2

- 3.4.1. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

- 3.4.2. A summary of sources identified within 250m of Section 2 of the proposed pipeline are presented in **Table 3.6** and a spatial plan is included as **Figure 11.1.3 (sheet 2), Annex A**.

Table 3.6 - Section 2 Potential Sources

Source	Contaminants
Made Ground associated with identified land uses (bullet pointed below) or unexpected Made Ground at agricultural land.	Asbestos, heavy metals, polyaromatic hydrocarbons (PAHs) 16, total petroleum hydrocarbons criteria working group (TPH CWG), volatile

Source	Contaminants
<ul style="list-style-type: none"> Existing industrial land; Stanlow Manufacturing Complex and the Gowy Landfill. Historic commercial / industrial land; GPSS Backford South. 	organic substances (VOCs) and semi-volatile organic substances (SVOCs).
Made Ground associated with infilled ponds, pits and quarries (e.g., Chorlton Quarry and Church Farm Sand Pit located 100m from the Newbuild Carbon Dioxide Pipeline in Backford).	Asbestos, heavy metals, PAH 16 and TPH CWG.
Made Ground associated with construction / historic use along the River Gowy and Shropshire Union Canal.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Railway and highway land.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Polychlorinated biphenyls (PCBs) relating to spillages / leakages at offsite electrical substations (see Section 8).	Asbestos, polychlorinated bi-phenyls (PCBs) heavy metals, PAH 16 and TPH CWG.
Free-phase contamination within groundwater relating to existing and historic industrial / commercial land use.	TPH CWG / VOCs / SVOCs
Hazardous gases associated with Made Ground and surrounding exiting and historic landfill operations; Gowy Landfill, Spring Bank Landfill and Thornton Green Landfill.	Carbon dioxide, methane and hydrogen sulphide
Hazardous vapours from groundwater impact related to existing and historic industrial / commercial land use.	TPH / VOC vapours and carbon dioxide and methane

PATHWAYS

- Direct contact, ingestion or inhalation of fibres or vapours;
- Inhalation of hazardous gases or vapours;
- Accumulation of hazardous gases or vapours (asphyxiation and explosive risk);

- Overland flow of groundwater;
- Lateral migration via unnamed streams and watercourses;
- Leaching of contaminants via the unsaturated zone into shallow groundwater;
- Vertical migration into superficial and bedrock aquifers; and
- Baseflow of groundwater to surface water features.

RECEPTORS

Human Health

- Construction workers during the construction phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e., dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;
- Deeper groundwater within bedrock;
- The surrounding water network, River Gowy, Mill Brook and Shropshire Union Canal; and
- The active registered surface water abstraction located 200m north at the Gowy Meadows (see Section 8).

Mineral Resources

- Identified superficial mineral resources along Section 2; sub-alluvial deposits, glaciofluvial deposits, peat and blown sand deposits.

The Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

4.

SECTION 3

4.1.

DESCRIPTION AND CURRENT USE

4.1.1.

An overview of Section 3 can be seen on **Figure 11.1.2 (sheet 3), Annex A** and pertinent details are summarised in **Table 4.1**.

Table 4.1 - Description of Section 3

Location (Start and End Point)	Start: North-bound carriageway of the A41 Liverpool Road (approximately 1.2km northwest of Chester Zoo), End: South-bound Carriageway of the A548 Sealand Road (0.5km southwest of the England-Wales border)
Length	Approximately 6.23km
National Grid Reference of Start and End Point:	Start: 339953, 371093, End: 335658, 368504
Current Land Use	The section predominantly comprises agricultural land with two railway crossings and an area understood to contain below ground tanks that is also recorded to have formally been a landfill.
Surrounding Area	<p>Prominent surrounding land use:</p> <ul style="list-style-type: none">• Agricultural land and farm buildings / yards (e.g. Grove Farm, Poplars Farm and Oulton's Farm etc);• Undeveloped parkland / developed recreation grounds (e.g. Former Mollington Grange Golf club, Mere Farm Fishery and the Saughall and Shotwick Park);• Small industrial yards (e.g., unlabelled yard 100m north of proposed pipeline, accessed from A41 Liverpool Road);• Railway Lines (existing Birkenhead to Chester Railway Line and dismantled Great Central Railway / London and North Eastern Railway, running along the Chester Millennium Greenway);• Major highways (A41, A540, A5116 and A548 roads);• Waterways (Shropshire Union Canal, culverted Backford Brook);• Military land use (Dale Barracks in Moston); and• Residential land use (suburbs of Mollington, Blacon and Saughall)

Elevation and Topography	Elevation across section three generally ranges between 10mAOD to 30mAOD. Much of the section ranges between 20m and 30mAOD in elevation but ground levels appear to slope downwards towards an unnamed stream located to the west of Saughall where levels return to between 10m and 20mAOD.
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4.2.

LAND USE HISTORY

4.2.1.

A summary of Section 3 pertinent features noted from a review of historical maps (Groundsure historical maps in **Annex B**) is presented in **Table 4.2**.

Table 4.2 - Pertinent History Section 3

Mapping Dates	Proposed Development Section and Immediate Surroundings (250m Buffer)	Wider Surroundings (1km Buffer)
1890s to 1930s	<p>Earliest available mapping shows land generally comprises undeveloped agricultural land intersected by small pockets occupied by residential properties and farmland, surface water features (Shropshire Union Canal, Backford Brook, numerous ponds and unnamed drains) and highway and rail infrastructure (Chester Railway Line and associated Mollington Station, London and North Eastern Railway Line, canal towpaths, carriageways and pathways).</p> <p>In addition, a sand pit, named Church Farm Sand Pit (1898 – 1968) is located 100m north of the proposed pipeline and west A41 Liverpool Road, to the eastern extent of the section.</p>	<p>Within the wider surroundings the majority of any development is centred around Backford, Moston Mollington, Saughall and Blacon. The following pertinent features have been identified (east to west):</p> <ul style="list-style-type: none"> • A smithy (1898 – 1968) 270m north, along Station Road. • A moat (1898 - 1968) 400m north, adjacent to Damage Lane. • A brickfield, named 'Mollington Brick Field' (1898 – 1968) 300m north, adjacent to Grove Road. • A fishpond, renamed to Mere Farm Fishery (1898 – to present) 260m south, in Mollington. • Overwood Cottage Brewery, renamed to Mollington Brewery (1898 - 1953) 270m west, adjacent

Mapping Dates	Proposed Development Section and Immediate Surroundings (250m Buffer)	Wider Surroundings (1km Buffer)
		<p>to the A540 Parkgate Road.</p> <ul style="list-style-type: none"> Saughall and Shotwick Park (1898 – present) 1km northwest, in Saughall.
1930 to 1950s	<p>In 1954 the surface workings at the offsite sand pit (identified above) have been extended and are now located within 50m of the Newbuild Carbon Dioxide Pipeline.</p>	<p>The Mollington Brewery (identified above) is no longer identified on 1953 mapping.</p> <p>There is a notable increase in residential land use in Blacon, 1km southeast.</p>
1950s to 1980s	<p>In 1968, Backford Brook, located to the east of Section 2, is culverted beneath Station Road and reappears south of the Shropshire Union Canal.</p> <p>In addition, the offsite sand pit is no longer identified by maps dated from 1968 and a hall named 'Five Villages Hall' and a garage is constructed on its footprint in 1980.</p>	<p>Historical maps dated identify the following:</p> <ul style="list-style-type: none"> The Smithy is now labelled 'The Old Smithy'; Mollington Brick Field is no longer identified and the area labelled as a water body; Mollington station is closed in 1960; and. Expansion of the developed centres of Backford, Moston, Mollington, Saughall and Blacon occurs.
1980s to present day	<p>From 2001 the Great Central Railway / London and North Eastern Railway is dismantled and replaced by a cycling / walking route known as the Chester Millennium Greenway.</p> <p>In addition, a nursery and two lodges (Pinetree Lodge and Kingswood Lodge) are</p>	<p>No significant changes or features identified within the surrounding area.</p>

Mapping Dates	Proposed Development Section and Immediate Surroundings (250m Buffer)	Wider Surroundings (1km Buffer)
	constructed in the centre of the section and within 50 m of the proposed pipeline at Kingswood Lane. Available aerial photography identifies ponds, nursery greenhouses and kennels within their vicinity.	

4.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

- 4.3.1. An overview of the extent of Section 3 against geological mapping and a summary of boreholes within this Section are presented in Annex H.
- 4.3.2. Made Ground is expected within the Newbuild Infrastructure Boundary and in the immediate surrounding area, associated with existing and historical development (identified in Section 4.2). BGS Mapping (**Ref. 13.1**) identifies the following superficial deposits along Section 3; Glaciofluvial Deposits, Glacial Till and Tidal Flats Deposits. These are further underlain by bedrock comprising the Chester Formation and the Kinnerton Sandstone Formation.

HYDROGEOLOGY

- 4.3.3. The Environment Agency classifies the Glaciofluvial Deposits as a Secondary A Aquifer and the Tidal Flats Deposits and Glacial Till as a Secondary Undifferentiated Aquifers. The Chester Formation and Kinnerton Sandstone are both classified as Principal Aquifers.
- 4.3.4. The section does not lie within, or within 250m of, a source protection zone (SPZ).

HYDROLOGY

- 4.3.5. A summary of the hydrology information for Section 3 is presented in **Table 4.3**, based on information contained within the Groundsure Report included in **Annex B**.

Table 4.3 - Section 3 Hydrology Summary

Catchment Areas	Features Identified <250m of Newbuild Carbon Dioxide Pipeline	Details
<p>Operational Catchment: Dee Estuary, Management Catchment: Dee, Water Body Catchment: Finchetts Gutter and Garden City Drain</p>	<p>This section intersects the culverted Backford Brook, the Shropshire Union Canal and several unnamed streams.</p> <p>Numerous ponds have also been identified within 250m of this section.</p>	<p>Backford Brook and the Shropshire Union Canal, located in the east of the section fall within the Finchetts Gutter Water Body Catchment, which has been classified with the following status' from the EA as of 2019 (most recent evaluation); ecological classification of poor, physico-chemical quality elements of poor to high and fails for concentrations of mercury (and Its compounds) and Polybrominated diphenyl ethers (PBDE).</p> <p>Unnamed water courses in the west of the section fall within the Garden City Drain Water Body Catchment, which has been classified with the following status' from the EA as of 2019 (most recent evaluation); ecological classification of moderate, physico-chemical quality elements of bad to high, high concentrations of copper and zinc and moderate concentrations of Triclosan and fails for concentrations of mercury (and Its compounds) and Polybrominated diphenyl ethers (PBDE).</p>

COAL MINING

- 4.3.6. A review of the Coal Authority Interactive mapping (**Ref.13.2**) online indicates that Section 3 is not within a Coal Mining Reporting Area. Coal

mining related stability risks are therefore not considered further within this section assessment.

QUARRYING AND MINERAL EXTRACTION

4.3.7. A review of the Groundsure report in **Annex B** regarding quarrying and mineral extraction in Section 3 is summarised in **Table 4.4**.

Table 4.4 - Summary of Quarrying and Mineral Extraction in Section 3

Feature	Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
Surface Ground Workings	<p>As detailed briefly in Section 4.2 Land History, numerous surface ground working features have been identified within 100m of Section 3 largely relating to ponds, but also the Shropshire Union Canal and cuttings along the Birkenhead to Chester Railway Line.</p> <p>In addition, a sand pit, identified as the Church Farm Sand Pit, has been located within 100m of the proposed pipeline, adjacent to the A41 Liverpool Road, to the eastern extent of the section.</p>	<p>As detailed briefly in Section 3.4 Land History, numerous surface working features have been identified within 250m of Section 3, again largely relating to ponds, but also unspecified pits and ground workings along the England – Wales Border and the Great Central Railway / London and North Eastern Railway Line.</p> <p>Within 250m the following features have also been identified;</p> <ul style="list-style-type: none"> • A historic brickfield, identified as Mollington Brick Field, located 300m north of the Newbuild Carbon Dioxide Pipeline, to the eastern extent of the section. • A surface mineral working in Backford for sand and gravel, located 600m north of the Newbuild Carbon Dioxide Pipeline to the eastern extent of the section. N.B the Backford sand and gravel pit is not shown on available historical maps.

Feature	Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
Historical Mineral Planning Areas	The BGS Mineral Resources map of Cheshire, identified Church Farm Sand Pit (described above) as a surface planning permission area (valid and expired) for sand and gravel extraction.	No historical mineral planning areas have been identified between 100 - 250m of the proposed pipeline. The Groundsure Report identifies two historical mineral planning areas, located between 550m – 600m of Section 3; Backford sand and gravel pit (as identified above) and Collinge Farm sand pit. These features are discussed in Section 2.
Other	None of the following features have been identified within the Study Area / 500m / 1km (as defined) of Section 3; <ul style="list-style-type: none"> • Natural Cavities (within 500m) • Historical Underground Workings (within 1km) • Historical Non-coal Mining Activities (within 1km) • Mining Cavities (within 1km) • Coal, clay and tin mining (within the Newbuild Infrastructure Boundary) • Gypsum and brine extraction areas (within the Newbuild Infrastructure Boundary) • The potential risk from the above features is therefore considered to be negligible. 	

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

- 4.3.8. A review of the BGS mapping (**Ref. 13.1**) identifies a very small area of Glaciofluvial Deposits, classified as a mineral resource, located to the eastern extent of Section 3.

NATURAL GROUND SUBSIDENCE

- 4.3.9. A summary of subsidence risks within Section 3 are present in **Table 4.5**.

Table 4.5 - Summary of Natural Ground Subsidence

Hazard	Rating (Within 50m of Newbuild Carbon Dioxide Pipeline Route)
Shrink Swell Clays	Negligible - very low
Running Sands	Very low - Moderate (moderate risk identified at the western extent).
Compressible Deposits	Negligible - moderate (moderate risk identified at the western extent).
Collapsible Deposits	Negligible - very low
Landslides	Very low – moderate
Ground Dissolution of Soluble Rocks	Negligible

FLOODING

Surface Water Flooding

- 4.3.10. Following a review of flood risk mapping for planning, the land located adjacent to the Shropshire Union Canal and Backford Brook to the east of the section has been identified within Flood Risk Zone 3, defined as *“Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding”*.
- 4.3.11. In addition, the land in Flintshire to the west of the section is identified to be located within Flood Risk Zone 2 and Flood Risk Zone 3. Flood Risk Zone 2 is defined as *“Land having a 1 in 1000 annual probability of river or sea flooding”*.

Groundwater Flooding

- 4.3.12. Much of Section 3 is defined as being at low risk from groundwater flooding. However, the risk of groundwater flooding increases to high in the east of the section adjacent the Shropshire Union Canal and Backford Brook, and in the west in Flintshire to the southwest of the England - Wales border.

SENSITIVE LAND USES

- 4.3.13. No sensitive environmental designations have been identified within 1km of Section 3 of the DCO Proposed Development.
- 4.3.14. A narrow strip of designated ancient woodland is located 1km southeast of the section, running parallel to the A548 Sealand Road. In addition, a SSSI and Special Area of Conservation (SAC), relating to the River Dee, are

located 1.5km southwest of Section 3. These features are discussed in Section 4.

AGRICULTURAL LAND DESIGNATION

- 4.3.15. Section 3 is not mapped in terms of agricultural land designation on MAGIC Maps (**Ref. 13.4**). The Agricultural Land Classification information contained within **Appendix 11-4 (Volume III)** indicates that Section 3 contains a mixture of Grades 2 – 3a.

SOIL TYPE

- 4.3.16. The expected soil types in Section 3 include;
- Loamy and clayey (slightly acid but base-rich) soils across the majority of the Section 3, which are slowly permeable (impeded drainage to stream network) and seasonally wet, with moderate to high fertility and low carbon.
 - Loamy and clayey soils in the west exclusively (relating to the Tidal Flat Deposits), which have naturally high groundwater, with lime-rich to moderate fertility and medium carbon.

IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- SECTION 3

- 4.3.17. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

- 4.3.18. A summary of sources identified within 250m of Section 3 of the proposed pipeline are presented in **Table 4.6** and a spatial plan is included as **Figure 11.1.3 (sheet 3), Annex A**.

Table 4.6 - Section 3 Potential Sources

Source	Contaminants
<p>Made Ground associated with identified land uses (bullet pointed below) or unexpected Made Ground at agricultural land.</p> <ul style="list-style-type: none"> • Existing commercial (garage), residential and farmland. • Historic ground workings (Church Farm Sand Pit). 	<p>Asbestos, heavy metals, polyaromatic hydrocarbons (PAHs) 16, total petroleum hydrocarbons criteria working group (TPH CWG), volatile organic substances (VOCs) and semi-volatile organic substances (SVOCs).</p>

Source	Contaminants
Made Ground associated with infilled ponds, pits and quarries.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Made Ground associated with construction / historic use of the Backford Brook and Shropshire Union Canal.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Railway (existing and historic) and highway land.	Asbestos, heavy metals, PAH 16 and TPH CWG.
Free-phase contamination within groundwater relating to existing and historic industrial / commercial land use.	TPH CWG / VOCs / SVOCs
Hazardous gases associated with infilled land, Made Ground and historic ground workings (e.g. Church Farm Sand Pit).	Carbon dioxide, methane and hydrogen sulphide
Hazardous vapours from groundwater impact related to existing and historic industrial / commercial land use.	TPH / VOC vapours and carbon dioxide and methane
Underlying bedrock (generally less than 1% properties affected by radon, although to the immediate east of the England – Wales border, radon action level increases to between 1% - 3%).	Radon

PATHWAYS

- Direct contact, ingestion or inhalation of fibres or vapours;
- Inhalation of hazardous gases or vapours;
- Accumulation of hazardous gases (asphyxiation and explosive risk);
- Overland flow of groundwater;
- Lateral migration via unnamed streams and watercourses;
- Leaching of contaminants via the unsaturated zone into shallow groundwater;
- Vertical migration into superficial and bedrock aquifers; and
- Baseflow of groundwater to surface water features.

RECEPTORS

Human Health

- Construction workers during the construction phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e. dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;
- Deeper groundwater within bedrock; and
- The surrounding water network, Backford Brook and Shropshire Union Canal.

Mineral Resources

- Identified glaciofluvial mineral resources located to the eastern extent of Section 3.

Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

5. SECTION 4

5.1. DESCRIPTION AND CURRENT USE

5.1.1. An overview of Section 4 can be seen on **Figure 11.1.2 (sheet 4), Annex A** and pertinent details are summarised in **Table 5.1**.

Table 5.1 - Description of Section 4

Location (Start and End Point)	Start: North-bound carriageway of the A548 Sealand Road (approximately 0.5km southwest of the England-Wales border), End: South-bound carriageway of the A550 Gladstone Way (approximately 600m south of the Queensferry Roundabout off the Aston Expressway).
Length	Approximately 6.55km
National Grid Reference of Start and End Point:	Start: 335658, 368504, End: 331541, 367248 3
Current Land Use	This section comprises predominantly agricultural land in the east and urban areas including Sandycroft, Pentre and Mancot in the west.
Surrounding Area	<p>Prominent surrounding land uses:</p> <ul style="list-style-type: none">• Agricultural land and farm buildings / yards predominantly in the east (e.g. Church Farm, Sealand Farm, Yew Tree Farm, Birchen Fields Farm etc);• Parkland / recreation grounds (e.g. Willows Park at Pentre and Fore Golf Course);• Railway land (North Wales Coast Railway Line, former London and North West Rail Line);• Major highways (A548, A494 B5129 and A550);• Waterways (River Dee, Broughton Brook);• Residential land use (within the suburbs of Sandycroft, Pentre and Mancot). and• Industrial business parks / estates at Pentre, Queensferry and Rectors Lane approximately 50m northeast; and Glendale Avenue Business Park, approximately 120m northeast.
Elevation and Topography	The majority of the section lies at an elevation of less than 10mAOD increasing to between 10m and 20m AOD north of Mancot.

5.2. LAND USE HISTORY

- 5.2.1. A summary of Section 4 pertinent features noted from a review of historical maps (Groundsure historical maps in **Annex B**) is presented in **Table 5.2**.

Table 5.2 - Pertinent History Section 4

Mapping Dates	DCO Proposed Development Section and Immediate Surroundings (approximately 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
1870s to 1900s	<p>Earliest available mapping presents agricultural land in the east of the section, which is intersected by few residential properties and farmland, surface water features (River Dee, many ponds and unnamed drains) and highway and rail infrastructure (North Wales Coast Railway Line, carriageways and pathways).</p> <p>The west of the section is more developed in comparison and is occupied by the towns of Pentre, Mancot and Sandycroft. Land use is predominantly residential, although the following industrial features are presented;</p> <ul style="list-style-type: none"> Queensferry Wireworks, disused in 1869 and becoming the Queensferry Corn Mill in 1898. Surface workings (clay pits and brickworks), coal mines and associated shafts are identified between Pentre and Mancot. Aston Hall Colliery Railway Line appears on maps dated 1898. 	<p>In the surrounding area, the main developments are centred around Sandycroft, Mancot and Pentre towards the west of the section</p> <p>The following key features have been identified (east to west):</p> <p>Various farms including Deeside Farm, Rake Farm, Lower Ash Farm, Little Mancot Farm, Plas Moor Farm etc.</p> <p>Sandycroft Foundry & Engine Works (1869 - 1938) 950m northwest, adjacent to the River Dee.</p> <p>Colliery and associated shafts (1869 – 1938) south of Mancot, 700m southwest.</p> <p>Gasworks (1869 - 1969) 1km south along Moor Lane, North of Hawarden.</p>
1900s to 1950s	<p>During this period, many of the surface workings and collieries are identified as ‘old’, suggesting activities are now redundant.</p> <p>In addition, the following key features have been identified (east to west):</p> <ul style="list-style-type: none"> Land to the south of the River Dee is identified as ‘liable to floods’. An engineering works appears in 1948, to the south of Sandycroft, 50m north of the proposed pipeline. A reservoir is identified 140m north of the proposed pipeline in Pentre. A new surface watercourse is identified crossing the section, northeast to southwest and flowing northeast. 	<p>Residential land use expands at Mancot, Pentre and Sandycroft.</p> <p>In addition, there is industrial expansion adjacent to the North Wales Coast Railway Line, with factories, sawmills and engine shed structures identified. A engineering, chemical works and several tanks also appear in 1938, in the footprint of the former Sandycroft Foundry & Engine Works.</p>
1950s to 1980s	<p>Throughout the 1950s to 1980s, there is the expansion of residential land use within 250m of the Newbuild Carbon Dioxide Pipeline.</p> <p>In addition, the following key features have been identified (east to west):</p> <ul style="list-style-type: none"> Hawarden Airport is constructed in 1963, although the airfield reduces in size in 1978 and hereafter is located 300m southwest. Development of the present-day industrial business parks to the northeast of Chester Road East from 1963 onwards. The Aston Hall Colliery Railway Line is identified as dismantled by 1969 maps. The reservoir located 140m north of the Newbuild Carbon Dioxide Pipeline in Pentre is not presented on 1969 mapping. 	<p>Continued expansion of the developed areas of Mancot, Pentre and Sandycroft. In addition, the following key features have been identified (east to west):</p> <ul style="list-style-type: none"> Construction of Sealand Nursery (1968 – present) 350m east, accessed from Deeside Lane, adjacent to the River Dee. Expansion of industrial works adjacent to the River Dee, in the footprint of the former Sandycroft Foundry & Engine Works from 1969 onwards. A caravan site (1963 – 2001) is constructed 440m north, at the location of former clay pits, northwest of Pentre.
1980s to present day	<p>Continued growth of surrounding towns, with residential development at Willow Park, Pentre, 50m north of the Newbuild Carbon Dioxide Pipeline, at the former colliery.</p> <p>In addition, the Fore Golf Club, Sealand, is identified within 50m of the Newbuild Carbon Dioxide Pipeline on maps dated 2001 onwards.</p>	<p>Continued industrial development at the industrial business parks / estates to the northeast of Chester Road East at Pentre, Queensferry, Rectors Lane and Glendale Avenue Business Park</p>

Mapping Dates	DCO Proposed Development Section and Immediate Surroundings (approximately 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
		In addition, variation in layout and construction of structures at Hawarden Airport from 2001 to present.

5.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

- 5.3.1. An overview of the extent of Section 4 against geological mapping and a summary of boreholes within this Section are presented in Annex H.
- 5.3.2. Made Ground is expected within the Newbuild Infrastructure Boundary and in the immediate surrounding area, associated with existing and historical development (identified in Section 5.2). BGS Mapping (**Ref. 13.1**) identifies Tidal Flat and Glacial Till superficial deposits along Section 4. These are further underlain by bedrock comprising the Kinnerton Sandstone Formation, Etruria Formation and Pennine Coal Measures Formations (Lower and Middle).

HYDROGEOLOGY

- 5.3.3. The Environment Agency classifies the Tidal Flats Deposits and the Glacial Till as a Secondary Undifferentiated Aquifers. The Kinnerton Sandstone is classified as Principal Aquifer, whilst the Etruria Formation and the Pennine Coal Measures Formations are classified as Secondary A Aquifers.
- 5.3.4. Section 4 of the proposed pipeline does not lie within, or within 250m of, a source protection zone (SPZ). However, it should be noted that a small section of the Newbuild Infrastructure Boundary falls within a SPZ 3 (total catchment) adjacent to the River Dee, north of Hawarden Airport.

HYDROLOGY

- 5.3.5. A summary of the hydrology information for Section 4 is presented in **Table 5.3**, based on information contained within the Groundsure Report in **Annex B**.

Table 5.3 - Section 4 Hydrology Summary

Catchment Areas	Features Identified <250m of Newbuild Carbon Dioxide Pipeline	Details
Operational Catchment: Dee Estuary Management Catchment: Dee Water Body Catchment: Finchetts Gutter and Sandycroft Drain	This section intersects the River Dee, Broughton Brook and several unnamed streams. Numerous ponds have also been identified within 250m of this section.	<p>The eastern extent of the section is located within the Finchetts Gutter Water Body Catchment, which has been classified with the following status' from EA as of 2019 (most recent evaluation); ecological classification of poor, physico-chemical quality elements of poor to high and fails for concentrations of mercury (and its compounds) and Polybrominated diphenyl ethers (PBDE).</p> <p>The River Dee, located in the centre of the section, has been classified with the following status' from NRW as of 2021 (most recent evaluation); ecological classification of moderate, high concentrations of many chemical contaminants including arsenic, copper, iron, manganese, toluene, zinc, anthracene, cadmium etc and classified with an overall water body status of moderate.</p> <p>The Broughton Brook, located to the west of the section, falls within the Sandycroft Drain Water Body Catchment, which has been classified with the following status' from NRW as of 2021 (most recent evaluation); ecological status of moderate, high concentrations of iron, manganese, nophenol and an overall water body status of moderate.</p>

COAL MINING

- 5.3.6. A review of the Coal Authority Interactive mapping online (**Ref. 13.2**) indicates that parts of Section 4 lie within a development high risk area requiring a coal mining report as a result of the following activities identified along, and within 100m, of the Newbuild Carbon Dioxide Pipeline route; surface coal resource areas and coal outcrops, probable and past shallow coal mine workings, several

mine entries and abandoned mine locations. A further review of the Coal Mining Risk including correspondence and reporting form the Coal Authority are presented in **Chapter 11 Land and Soils**.

QUARRYING AND MINERAL EXTRACTION

5.3.7. A review of the Groundsure report regarding quarrying and mineral extraction in Section 4 is summarised in **Table 5.4**.

Table 5.4 - Summary of Quarrying and Mineral Extraction in Section 4

Feature	Newbuild Carbon Dioxide Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
Mining and Ground Workings (surface and underground)	<p>As detailed briefly in Section 5.2 Land History, numerous surface ground working features have been identified within 100m of Section 4 and are predominantly clustered to the west.</p> <p>To the west of the Section, the identified surface ground workings include several areas of historic known / likely surface and underground workings including the now ceased Clay Hill Colliery, Queensferry Road Colliery and brickworks in Pentre and Big Mancot Colliery in Mancot.</p> <p>To the east of the section, surface workings identified exclusively relate to ponds.</p>	<p>As detailed briefly in Section 5.2 Land History, numerous surface ground working features have been identified within 250m of Section 4, again largely relating to historic clay / sand pits and collieries in Pentre and Mancot.</p> <p>Within 250m surface workings related to ponds also increase and the following features related to underground mining have also been identified;</p> <p>Historic underground lead mining at the Mechanic's Arms Mine, located 250m north in Deeside.</p> <p>Historic natural gas extraction at Yew Tee Farm, located 250 northwest in Sealand.</p>
Other	None of the following features have been identified within the Study Area / 500m / 1km (as defined) of Section 4;	

Feature	Newbuild Carbon Dioxide Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
	<ul style="list-style-type: none"> • Natural Cavities (within 500m) • Historical Non-coal Mining Activities (within 500m) • Mining Cavities (within 1km) • Clay and tin mining (within the Newbuild Infrastructure Boundary) • Gypsum and brine extraction areas (within the Newbuild Infrastructure Boundary) <p>The potential risk from the above features is therefore considered to be negligible.</p>	

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

- 5.3.8. A review of the BGS mapping identifies primary and secondary shallow coal and brick clay mineral resources to the western extent of Section 4.

NATURAL GROUND SUBSIDENCE

- 5.3.9. A summary of subsidence risks within Section 4 are present in **Table 5.5**.

Table 5.5 - Summary of Natural Ground Subsidence

Hazard	Rating (Within 50m of Newbuild Carbon Dioxide Pipeline Route)
Shrink Swell Clays	Very low
Running Sands	Very low - moderate (moderate risk identified for the tidal flat deposits located within approximately 750m of the River Dee at Sandycroft, Hawarden Airport and to the northeast of Pentre and Mancot)).
Compressible Deposits	Negligible - moderate (moderate risk identified for the tidal flat deposits located within approximately 750m of the River Dee at Sandycroft, Hawarden Airport and to the northeast of Pentre and Mancot).
Collapsible Deposits	Negligible - very low (very low relating to the glacial till deposits located to the west of the section)
Landslides	Very low
Ground Dissolution	Negligible

FLOODING

Surface Water Flooding

- 5.3.10. Following a review of flood risk mapping for planning, much of Section 4 (all land along and to the northeast of Chester Road East to the A548 Sealand Road) is identified to be located within Flood Risk Zone 2 and Flood Risk Zone 3, as defined below;
- Flood Risk Zone 2: “Land having a 1 in 1000 annual probability of river or sea flooding”.
 - Flood Risk Zone 3: “Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding”.

Groundwater Flooding

- 5.3.11. The risk of groundwater flooding across Section 4 is generally high, with risk reducing to moderate - high to the northeast of the River Dee and low to the southwest of Mancot.

SENSITIVE LAND USES

- 5.3.12. The River Dee, located in the centre of Section 4, is a designated SSSI and SAC. In addition, two areas of ancient woodland (restored and semi-natural)

have been identified within 1km of section; 760m northwest at Little Mancot and 800m southeast at Sealand. The latter designated ancient woodland area is located immediately adjacent to the Newbuild Infrastructure Boundary.

- 5.3.13. No other sensitive environmental designations have been identified within 1km of Section 4 of the DCO Proposed Development.

AGRICULTURAL LAND DESIGNATION

- 5.3.14. Section 4 includes Grade 2 (best and most versatile) agricultural land and land designated as 'urban areas' according to MAGIC Maps (**Ref. 13.4**). The Agricultural Land Classification information contained within **Appendix 11-4 (Volume III)** indicates that Section 4 contains a mixture of Grades 1, 2, 3a, 3b and non-agricultural land.

SOIL TYPE

- 5.3.15. The expected soil types in Section 4 include;
- Loamy and clayey soils across much of the section (relating to the tidal flat deposits), which have naturally high groundwater, with lime-rich to moderate fertility and medium carbon.
 - Loamy and clayey (slightly acid but base-rich) soils exclusively to the west of the section (related to glacial till deposits), which are slowly permeable (impeded drainage to stream network) and seasonally wet, with moderate fertility and low carbon.

5.4. IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- SECTION 4

- 5.4.1. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

- 5.4.2. A summary of potential sources identified within 250m of Section 4 of the Newbuild Carbon Dioxide Pipeline are presented in Table 5-6 and a spatial plan is included as **Figure 11.1.3 (sheet 4), Annex A**.

Table 5.6 - Section 4 Potential Sources

Source	Contaminants
<p>Made Ground associated with identified land uses (bullet pointed below) or unexpected Made Ground at agricultural land.</p> <ul style="list-style-type: none"> Existing industrial land; Industrial business parks / estates at Pentre, Queensferry and Rectors Lane approximately 50m northeast; and Glendale Avenue Business Park, approximately 120m northeast. Existing residential land; villages of Sandycroft, Pentre and Mancot. Historical and existing commercial land; Hawarden Airport in the 1960s and within 300m from 1978 onwards. Historical industrial land; mining and ground workings (surface and underground), wireworks and subsequent corn mill. 	<p>Asbestos, heavy metals, polyaromatic hydrocarbons (PAHs) 16, total petroleum hydrocarbons criteria working group (TPH CWG), volatile organic substances (VOCs) and semi-volatile organic substances (SVOCs).</p>
<p>Made Ground associated with infilled historic ground workings, pits, reservoirs and ponds (e.g. Clay Hill Colliery, Queensferry Road Colliery and brickworks in Pentre and Big Mancot Colliery in Mancot).</p>	<p>Asbestos, heavy metals, PAH 16 and TPH CWG</p>
<p>Made Ground associated with construction / historic use of the River Dee.</p>	<p>Asbestos, heavy metals, PAH 16 and TPH CWG</p>
<p>Railway (existing and historic) and highway land.</p>	<p>Asbestos, heavy metals, PAH 16 and TPH CWG</p>
<p>Free-phase contamination within groundwater relating to existing and historic industrial / commercial land use.</p>	<p>TPH CWG / VOCs / SVOCs</p>
<p>Hazardous gases associated with Made Ground, historic ground workings and historic landfills (more information on landfills is provided during the later Regulatory Information section).</p>	<p>Carbon dioxide, methane and hydrogen sulphide</p>
<p>Hazardous vapours from groundwater impact related to existing and historic industrial / commercial land use.</p>	<p>TPH / VOC vapours and carbon dioxide and methane</p>

Source	Contaminants
Underlying bedrock (generally less than 1% of properties affected by radon, although to the north of Mancot and in Sandycroft, radon action level increases to between 1% - 10%.	Radon

PATHWAYS

- Direct contact, ingestion or inhalation of fibres or vapours;
- Inhalation of hazardous gases or vapours;
- Accumulation of hazardous gases (asphyxiation and explosive risk);
- Overland flow of groundwater;
- Lateral migration via unnamed streams and watercourses;
- Leaching of contaminants via the unsaturated zone into shallow groundwater;
- Vertical migration into superficial and bedrock aquifers; and
- Baseflow of groundwater to surface water features.

RECEPTORS

Human Health

- Construction workers during the construction phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e. dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;
- Deeper groundwater within bedrock; and
- The surrounding water network, Broughton Brook and the River Dee.

Environmentally Sensitive Sites

- Flora and fauna within the nearby environmentally sensitive sites (e.g., onsite River Dee which is a designated SSSI and SAC).

Mineral Resources

- Identified primary and secondary shallow coal and brick clay mineral resources located to the western extent of Section 4.

Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

6. SECTION 5

6.1. DESCRIPTION AND CURRENT USE

6.1.1. An overview of Section 5 can be seen on **Figure 11.1.2 (sheet 5), Annex A** and pertinent details are summarised in **Table 6.1**.

Table 6.1 - Description of Section 5

Location (Start and End Point)	Start: North-bound carriageway of the A550 Gladstone Way (approximately 600m south of the Queensferry Roundabout off the Aston Expressway), End: West-bound Carriageway of the B5126 Connah's Quay Road (approximately 1km east of the centre of Northop).
Length	Approximately 8.30km.
National Grid Reference of Start and End Point:	Start: 331541, 367248, End: 325644, 368520
Current Land Use	This section comprises predominantly agricultural land located on the outskirts of Aston and Ewloe Green to the east and Northop Hall to the west. The western section runs approximately parallel to the existing A55 North Wales Expressway.
Surrounding Area	<p>Prominent surrounding land uses:</p> <ul style="list-style-type: none">• Agricultural land and farm buildings / yards (Aston Hill Farm, New Inn Bridge Farm, Ewloereen Farm, etc.).• Parkland / recreation grounds (e.g. Wepre Park, Brook Park, Northop Hall Cricket Club, Ewloe Castle and Northop Country Park Golf Club).• Residential land use (within the suburbs of Aston, Ewloe Green and Northop Hall).• Railway land (the Wrexham Mold and Connah's Quay Railway Line, now identified as the Borderlands Line, Great Central Railway / London and North Eastern Railway Line and dismantled Aston Hall Colliery Railway Line).• Major highways (A550, A494, B5125, A55 and B5126).• Waterways (New Inn Brook, Wepre Brook, Alltami Brook).

	<p>Notable trades within 250m of Section 5:</p> <ul style="list-style-type: none"> • A scrapyard approximately 50m north at Old Aston Hill, Ewloe; • Two service stations located on the A55 North Wales Expressway (220m southwest, accessed from the north-bound carriageway and 30m south, access from the south-bound carriageway). • One petrol station located approximately 20m south at Newbridge Farm, access from Holywell Road. • Alltami Clay Quarry, located approximately 200m south, bound by the A55 in the north and the A494 in the south.
Elevation and Topography	<p>Ground levels at the start are approximately 20m AOD but increase northwest towards Ewloe Castle to approximately 90m AOD. Levels remain at approximately 90m AOD further northwest adjacent to the A55 and then increase to between 100m and 110m AOD adjacent to the east of Northop Hall.</p>

6.2. LAND USE HISTORY

6.2.1. A summary of Section 5 pertinent features noted from a review of historical maps (Groundsure historical maps in **Annex B**) is presented in **Table 6.2**.

Table 6.2 - Pertinent History Section 5

Mapping Dates	DCO Proposed Development Section and Immediate Surroundings (approximately 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
1870s to 1900s	<p>Earliest available mapping presents agricultural land which is intersected by few residential properties and farmland, woodland (Wared Wood, Ewloebarn Wood and Wepre Wood) surface water features (New Inn Brook, Wepre Brook, Alltami Brook, many ponds and unnamed drains) and highways and rail infrastructure (the Wrexham Mold and Connah's Quay Railway Line, now identified as the Borderlands Line, Great Central Railway / London and North Eastern Railway Line and Aston Hall Colliery Railway Line, carriageways and pathways).</p> <p>In addition, the following industrial / commercial land features are presented.</p> <ul style="list-style-type: none"> • Surface and underground mining features including sand / clay / gravel pits, brickworks, shafts, collieries and associated spoil heaps at Aston, Ewloe Green and Northop Hall. A brickworks is shown at the location of the proposed pipeline in 1898, to the west of the existing A550 carriageway. • Two wells located at an unidentified farm, located 90m north at Old Aston Hill, Ewloe. • Castle Hill Brewery at Ewloe, 190m northwest (1869 – 1948). 	<p>In the surrounding area, the main developments are centred around Aston, Ewloe, Ewloe Green and Northop Hall.</p> <p>The following key features have been identified (east to west):</p> <ul style="list-style-type: none"> • Many surface and underground mining features including the Aston Hall Brickworks, Aston Hall Colliery, Ewloe Hall Colliery, Castle Brickworks, Elm Collieries, Ewloebarn Brickworks etc. Ground workings are concentrated at the existing Alltami Clay Quarry, to the west of the section. <p>N.B the present-day village of Northop Hall is identified as 'Northophall' between 1898 to 1970.</p>
1900s to 1950s	<p>Many of the ground workings are now identified as 'disused' or 'old'. In addition, the following key features have been identified (east to west):</p> <ul style="list-style-type: none"> • A rectangular reservoir is identified 180m northeast in Pentre in 1909. • Sewage Works is identified 200m southeast in Aston in 1948. • A circular reservoir is identified 60m north at Old Aston Hill, Ewloe in 1910. 	<p>Expansion of residential land use and infrastructure at Aston, Ewloe, Ewloe Green and Northop Hall.</p> <p>Many of the ground workings in the surrounding area are now identified as 'disused' or 'old', however the ground workings at the existing Alltami Clay Quarry, to the west of the section, continue to expand.</p>
1950s to 1980s	<p>The following key features have been identified (east to west):</p> <ul style="list-style-type: none"> • The brickworks to the west of the existing A550 carriageway is no longer identified from 1969 onwards and the sewage works to the southeast Aston is labelled a water works from 1978. • Aston Hall Colliery Railway Line is labelled as dismantled in 1968. • The sand pits and circular reservoir identified immediately north at Old Aston Hill, Ewloe are no longer identified from 1970 onwards. These features are replaced by several embankments / mounds within 50m of the proposed pipeline. • In 1981, a new rectangular reservoir is constructed at Old Aston Hill to replace the former circular reservoir. • Wrexham Mold and Connah's Quay Railway Line, now identified as the Borderlands Line, is labelled as dismantled in 1970. • Check Point Country Park is identified adjacent to Brook Park Farm in Northop Hall, 100m north, in 1970. • An unidentified works (potential for structures and tanks) is located 80m north and adjacent to the Wepre Brook at Northop Hall in 1963 and 1970. • Cricket Ground at Northop Hall is identified 200m north, in 1970. • The A55 North Wales Expressway is constructed and appears on maps dated from 1981. 	<p>Continued expansion of residential land use and infrastructure at Aston, Ewloe, Ewloe Green and Northop Hall, noticeably from the 1970s onwards. By the late 1980s the surrounding infrastructure presented on mapping is very similar to the present-days layout, with the construction of the Ewloe Interchange and St David's Park Interchange.</p> <p>Ground workings at the existing Alltami Clay Quarry, to the west of the section, continue to expand. However, by 1970, many of the ground workings are identified as 'disused' and area begins to become occupied by warehouses, workshops and depots.</p>

Mapping Dates	DCO Proposed Development Section and Immediate Surroundings (approximately 250m Buffer)	Wider Surroundings (approximately 1km Buffer)
1980s to present day	<p>The following key features have been identified (east to west):</p> <ul style="list-style-type: none"> Two disused shafts, likely associated with surrounding historical collieries, are shown to intercept the centre of the proposed section to the southeast of Northop Hall in 1991. The two service stations (including fuel filling stations) located on the A55 North Wales Expressway (220m southwest, accessed from the north-bound carriageway and 30m south, access from the south-bound carriageway) are constructed and appear on maps dated from 1991 onwards. A large, raised platform is presented in 1991 along Shotton Lane, Ewloe. This feature is not labelled but available information contained within the Groundsure Report in Annex B suggests that this area was once occupied by a landfill (see identified sources – pathways – receptors for Section 5 for more information). A nursesey is identified within 50m of the proposed pipeline along Lower Aston Hall Lane, Ewloe. The former sewage works and subsequent water works identified to the southeast Aston is labelled as a reservoir from 2001 to 2010, before disappearing from mapping dated 2022. 	<p>Continued expansion of residential land use and infrastructure at Aston, Ewloe, Ewloe Green and Northop Hall,</p> <p>The former ground workings at the existing Alltami Clay Quarry, to the west of the section, are now labelled as water bodies between 1991 to 2010. Mapping from 2021 suggests that these features have since been infilled and the area reworked, identified as Alltami Clay Quarry.</p>

6.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

- 6.3.1. An overview of the extent of Section 5 against geological mapping and a summary of boreholes within this Section are presented in **Annex H**.
- 6.3.2. Made Ground is expected within the Newbuild Infrastructure Boundary and in the immediate surrounding area, associated with existing and historical development (identified in Section 6.2). BGS Mapping (**Ref. 13.1**) identifies superficial deposits comprising Glacial Till, intermittent with Glaciofluvial and Head deposits along Section 5. These are further underlain by bedrock comprising the Pennine Coal Measures Formations (Lower and Middle including Hollin Rock Member), Gwespyr Sandstone, Bowland Shale Formation and Etruria Formation.

HYDROGEOLOGY

- 6.3.3. The Environment Agency classifies the Glacial Till and Head Deposits as a Secondary Undifferentiated Aquifer and Glaciofluvial Deposits as a Secondary A Aquifer. The underlying Bowland Shale Formation bedrock is classified as a Secondary Undifferentiated Aquifer. All of the other identified bedrock deposits are classified as Secondary A Aquifers.
- 6.3.4. The Section does not lie within, or within 250m of, a source protection zone (SPZ).

HYDROLOGY

- 6.3.5. A summary of the hydrology information for Section 5 is presented in **Table 6.3**, based on information contained within the Groundsure Report in **Annex B**.

Table 6.3 - Section 5 Hydrology Summary

Catchment Areas	Features Identified 250m of Newbuild Carbon Dioxide Pipeline	Details
Operational Catchment: Dee Estuary Management Catchment: Dee Water Body Catchment: Wepre Brook & Sandycroft Drain	This section intersects New Inn Brook, Wepre Brook and several unnamed streams. In addition, the Alltami Brook (a water framework directive receptor) is located within 250m of the Newbuild Carbon Dioxide Pipeline. Numerous ponds have also been identified within 250m of this section.	The eastern extent of the section is located within the Sandycroft Drain Water Body Catchment, which has been classified with the following status' from NRW as of 2021 (most recent evaluation); ecological status of moderate, high concentrations of iron, manganese, noyphenol and an overall water body status of moderate. The New Inn Brook, Wepre Brook and Alltami Brook, located in the western extent of the section, are located within the Wepre Brook Water Body Catchment, which has been classified with the following status' from NRW as of 2021 (most recent evaluation); ecological status of moderate and an overall water body status of moderate. N.B chemical concentrations are not reported.

COAL MINING

- 6.3.6. A review of the Coal Authority Interactive mapping online (**Ref. 13.2**) indicates that there are many areas along Section 5 which lie within a development high risk area. As such, mapping determines that the entire section requires a coal mining report as a result of the following activities identifies along, and within 100m, of the proposed pipeline route; surface coal resource areas and coal outcrops, probable and past shallow coal mine workings, surface mining (past and current), several mine entries and abandoned mine locations.
- 6.3.7. Two Coal Mining Consultants Reports from the Coal Authority (included in **Annex D**; Refence Numbers 51002524473001 and 51002513967001) have been reviewed and **Table 6.4** summarises the most pertinent findings.

Table 6.4 – Coal Authority Coal Mining Report Summary for Section 5

Feature	Information
Past underground mining	Past underground mining of numerous seams, including the Main, Brassey, Premier (Lower Foot), Queen, Hollin and Yard have been identified beneath the Newbuild Carbon Dioxide Pipeline and in the surrounding area (to the south, south-east and west).
Probable unrecorded shallow workings	The Coal Authority reports that it is likely for probable unrecorded shallow workings to exist at or close to the surface (less than 30m deep) of the Newbuild Carbon Dioxide Pipeline, with probability increasing to the east.
Spine roadways at shallow depths	None recorded within 10m of the Newbuild Carbon Dioxide Pipeline.
Mine entries	A total of 32 mine entries (shafts and adits) have been within the vicinity of the Newbuild Carbon Dioxide Pipeline, very few of which have been treated under correct permitting and supervision.
Abandoned Mine Plans	The Coal Authority report identifies several abandoned mine catalogue entries which intersect the Newbuild Carbon Dioxide Pipeline.
Outcrops	The 'workable' coal outcrops of the Main Coal Seam and Brassey Coal Seam have been identified beneath the proposed pipeline.
Faults, Fissures and Breaklines	This information is displayed by summary figures provided within each report. The figures show a number of faults, adits and disused mine shafts intersecting the central area of the section (concentrated in the south-east of Northop Hall). Unlicensed opencast worked areas are also identified on the eastern outskirts of Aston and to the north of Northop Hall.
Opencast Mining	
Coal Authority Managed Tips	None recorded within 500m of the proposed pipeline.
Coal Mining Subsidence	<ul style="list-style-type: none"> • No damage notices or claims within the Newbuild Infrastructure Boundary or within 100m of the Newbuild Infrastructure Boundary since October 1994. • No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence. • No current Stop Notice delaying the start of remedial works or repairs to the Newbuild Infrastructure Boundary. • Not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act.
Mine gas	None recorded within 500m of the Newbuild Carbon Dioxide Pipeline.
Mine water treatment schemes	None recorded within 500m of the Newbuild Carbon Dioxide Pipeline.
Future Mining and Coal Mining Licensing	None recorded within 200m of the Newbuild Carbon Dioxide Pipeline.
Withdrawal of support notices	The Newbuild Carbon Dioxide Pipeline is not in an area where a notice to withdraw support was given in 1944. No notices have been issued.

- 6.3.8. Both of the Coal Authority coal mining reports conclude that further investigation is required. The report produced for north of Mancot to the south of Pentre (Report reference 51002524473001) also states that the eastern extents of the Section are close to where the Coal Authority have previously investigated and remediated mine entries and / or shallow coal mine workings following specific reported hazards.

QUARRYING AND MINERAL EXTRACTION

- 6.3.9. A review of the Groundsure report regarding quarrying and mineral extraction in Section 5 is summarised in **Table 6.5**.

Table 6.5 - Summary of Quarrying and Mineral Extraction in Section 5

Feature	Newbuild Carbon Dioxide Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
Mining and Ground Workings (surface and underground)	<p>As detailed in Section 6.3 Land History, numerous surface ground working features have been identified within 100m of Section 5 and are largely related to historic ground workings including the now ceased collieries; Clay Hill and Aston Hall, located to the eastern extents. In addition to the now ceased surface workings (Dublin Main sand and gravel pit) and collieries (Dublin Main Colliery and an unnamed quarry at Boar's Head Farm) in Northop Hall.</p> <p>The Groundsure Report in Annex B also identifies unspecified disused shafts, intercepting the centre of the proposed section, adjacent to Pinfold Lane, southeast of Northop Hall.</p> <p>Many unspecified and refuse heaps, associated with the identified workings, are located within 100m of the Newbuild Carbon Dioxide Pipeline. Whilst entries relating to ponds and cuttings along highway and railway infrastructure are less frequently reported.</p>	<p>As detailed briefly in Section 6.2 Land History, numerous surface working features have been identified within 250m of Section 5, again largely relating to historic collieries and surface workings (sand / coal / sandstone).</p> <p>In addition, a ceased underground lead mine has been identified to the north of Ewloe, approximately 150m north of the proposed pipeline, adjacent to Shotton Lane.</p> <p>Many unspecified shafts and heaps (unspecified and refuse), associated with the identified workings, are located within the 250m buffer.</p> <p>The three reservoirs identified in section 6.2 to the east of the section (in Ewloe and Pentre) are also classified as surface ground workings.</p>
Historical Mineral Planning Areas	No historical mineral planning areas have been identified within 100m of the Newbuild Carbon Dioxide Pipeline.	Two historical mineral planning areas have been identified between 50 – 250m of the proposed pipeline. Both entries are located at a site named 'New Works', located between approximately 170 – 250m southwest of Section 5. The Groundsure Report does not contain entries for the type of mineral or the planning status, however mapping of these areas suggests that they are located within the existing Alltami Clay Quarry.
Non-coal Mining	The Groundsure Report identifies many entries relating to localised small scale and sporadic underground mining for iron ore (bedded) and vein mineral deposits within 250m of the Newbuild Carbon Dioxide Pipeline.	
Natural Cavities	No natural cavities have been identified within 100m of the Newbuild Carbon Dioxide Pipeline.	One entry of a swallow hole has been identified within 70m of the proposed pipeline adjacent to Aston Hall Farm, along Shotton Lane, Ewloe.
Other	<p>None of the following features have been identified within the Study Area / 1km (as defined) of Section 5;</p> <ul style="list-style-type: none"> • Mining Cavities (within 1km) • Clay and tin mining (within the Study Area) • Gypsum and brine extraction areas (within the Study Area) <p>The potential risk from the above features is therefore considered to be negligible.</p>	

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

- 6.3.10. A review of the BGS mapping (**Ref. 13.1**) identifies primary and secondary shallow coal, glaciofluvial deposits and brick clay mineral resources along the route of Section 5.

NATURAL GROUND SUBSIDENCE

- 6.3.11. A summary of subsidence risks within Section 5 are present in **Table 6.6**.

Table 6.6 - Summary of Natural Ground Subsidence

Hazard	Rating (Within 50m of Newbuild Carbon Dioxide Pipeline Route)
Shrink Swell Clays	Negligible - very low
Running Sands	Negligible – moderate (generally very low with moderate risk surrounding the natural cavity identified in Ewloe)
Compressible Deposits	Negligible - moderate (moderate risk to the east of Aston)
Collapsible Deposits	Very low - negligible
Landslides	Very low – moderate (moderate risk to the southeast of Northop Hall, adjacent to the Wepre Brook and its northern tributary)
Ground Dissolution of Soluble Rocks	Negligible

FLOODING

Surface Water Flooding

- 6.3.12. Following a review of flood risk mapping for planning, the land to the south of Northop Hall and immediately adjacent to the Wepre Brook and its northern tributary, is identified to lie within Flood Zone Risk 2 and Flood Zone Risk 3, as defined below;
- Flood Risk Zone 2: *“Land having a 1 in 1000 annual probability of river or sea flooding”*.
 - Flood Risk Zone 3: *“Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding”*.

Groundwater Flooding

- 6.3.13. The risk of groundwater flooding across Section 5 is generally negligible to low, with risk increasing to moderate to the north of Ewloe Green.

SENSITIVE LAND USES

- 6.3.14. The following sensitive land uses are recorded within 1km of Section 5:
- Designated SSSI at Connah's Quay Ponds and Woodland (40m north in Ewloe), Buckley Claypits and Commons (800m – 1km west and south in Buckley) Maes Y Grug (1km south in Mold).
 - Designated SAC at Deeside and Buckley Newt sites (60m north in Ewloe, 620m northwest in Northop Hall and 800m – 1km west and south in Buckley)
 - Many records of designated ancient woodland are identified within 1km of Section 5, concentrated along the watercourses. Two pockets of designated ancient woodland (semi-natural and restored) are positioned along the northern tributary of the Wepre Brook, south of Northop Hall, and within 50m of the Newbuild Carbon Dioxide Pipeline.
- 6.3.15. No other sensitive environmental designations have been identified within 1km of Section 5 of the DCO Proposed Development. The nearest local nature reserve (LNR) is at the Gathering Grounds Wood and Llwyni Pond located approximately 1.3km north in Connah's Quay.

AGRICULTURAL LAND DESIGNATION

- 6.3.16. Section 5 includes Grade 2 and 3a (best and most versatile) and Grade 3b and Grade 4 agricultural land and land designated as 'urban areas' according to MAGIC Maps (**Ref. 13.4**). The Agricultural Land Classification information contained within **Appendix 11-4 (Volume III)** indicates that Section 5 is predictive Grade 3a however much of the area could not be surveyed due to access restrictions.

SOIL TYPE

- 6.3.17. The expected soil types in Section 5 include;
- Loamy and clayey (slightly acid but base-rich) soils across the majority of the section (related to glacial till deposits), which are slowly permeable (impeded drainage to stream network) and seasonally wet, with low to moderate fertility and low to medium carbon.
 - Loamy (slightly acid) soils to the north of Ewloe (related to glaciofluvial and head deposits), which are freely draining, with low fertility and low carbon.

6.4. IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- SECTION 5

- 6.4.1. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

- 6.4.2. A summary of potential sources identified within 250m of Section 5 of the proposed pipeline are presented in **Table 6.7** and a spatial plan is included as **Figure 11.1.3 (sheet 5), Annex A.**

Table 6.7 - Section 5 Potential Sources

Source	Contaminants
<p>Made Ground associated with identified land uses (bullet pointed below) or unexpected Made Ground at agricultural land.</p> <ul style="list-style-type: none"> Existing commercial land; scrapyards, service stations, petrol station and Alltami Clay Quarry. Existing residential land; villages of Aston, Ewloe Green and Northop Hall. Historical industrial land; mining and ground workings (surface and underground), brewery, sewage works / water works, unidentified works (at Northop Hall) and reservoirs. 	Asbestos, heavy metals, polyaromatic hydrocarbons (PAHs) 16, total petroleum hydrocarbons criteria working group (TPH CWG), volatile organic substances (VOCs) and semi-volatile organic substances (SVOCs).
Made Ground associated with infilled historic ground workings, pits, reservoirs and ponds (e.g., Clay Hill Colliery, Aston Hall Colliery and Dublin Main Colliery).	Asbestos, heavy metals, PAH 16 and TPH CWG
Railway (existing and historic) and highway land	Asbestos, heavy metals, PAH 16 and TPH CWG
Polychlorinated biphenyls (PCBs) relating to spillages / leakages at offsite electrical substations (see Section 8).	Asbestos, polychlorinated bi-phenyls (PCBs) heavy metals, PAH 16 and TPH CWG.
Free-phase contamination within groundwater relating to the current or former industrial / commercial land uses.	TPH CWG / VOCs / SVOCs
<p>Hazardous gases associated with Made Ground, historic ground workings and historic landfills.</p> <p>Five historic / recently active landfill entries are recorded within 250m of Section 5.</p> <p>N.B Not all historic landfills are identified in Section 6.2 Land History due to unavailable mapping and / or unidentified features. More information on landfills is provided during the later Regulatory Information section.</p>	Carbon dioxide, methane and hydrogen sulphide
Hazardous vapours from groundwater impact related to existing and historic industrial / commercial land use.	TPH / VOC vapours and carbon dioxide and methane
Underlying bedrock (generally between 5 – 30% of properties affected by radon, although there are areas along Section 5 where radon action level increases to greater than 30%).	Radon

PATHWAYS

- Direct contact, ingestion or inhalation of fibres or vapours;
- Inhalation of hazardous gases or vapours;
- Accumulation of hazardous gases (asphyxiation and explosive risk);
- Overland flow of groundwater;
- Lateral migration via unnamed streams and watercourses;
- Leaching of contaminants via the unsaturated zone into shallow groundwater;
- Vertical migration into superficial and bedrock aquifer; and
- Baseflow of groundwater to surface water features.

RECEPTORS

Human Health

- Construction workers during the construction phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e. dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;
- Deeper groundwater within bedrock; and
- The surrounding water network, Wepre Brook, New Inn Brook and Alltami Brook.

Environmentally Sensitive Sites

- Flora and fauna within the nearby environmentally sensitive sites (i.e., SSSI's, SAC's and designated ancient woodland).

Mineral Resources

- Identified primary and secondary shallow coal, glaciofluvial deposits and brick clay mineral resources located along the route of Section 5.

Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

7. SECTION 6

7.1. DESCRIPTION AND CURRENT USE

7.1.1. An overview of Section 6 can be seen on **Figure 11.1.2 (sheet 6), Annex A** and pertinent details are summarised in **Table 7.1**.

Table 7.1 - Description of Section 6

Location (Start and End Point)	Start: East-bound Carriageway of the B5126 Connah's Quay Road (approximately 1km east of the centre of Northop), End: Proposed for the Flint Above Ground Installation (AGI), located east Alt-Gooch Lane and approximately 2.15km to the southeast of the centre of Flint.
Length	Approximately 2.86km
National Grid Reference of Start and End Point:	Start: 325644, 368520, End: 325322, 371096
Current Land Use	The section comprises predominantly agricultural land, located approximately 1km east of the A5119 Northop Road.
Surrounding Area	Prominent surrounding land uses: <ul style="list-style-type: none">• Agricultural land and farm buildings / yards (Ty'n-y-coed Farm, Bryn Mawr Farm, Tros-y-mynydd Farm, Little Leadbrook Farm etc);• Woodland (Leadbrook Wood and Oakenholt Wood);• Waterways (Northop Brook, Lead Brook, Pentre Brook); and,• Major highways (A55, A5119, A548 and B5126)
Elevation and Topography	Elevations range from approximately 90m AOD to 40m AOD. Section 6 sits at approximately 90m AOD for much of the section with a downwards slope towards the northeast after Bryn Mawr farm.

7.2. LAND USE HISTORY

7.2.1. A summary of Section 6 pertinent features noted from a review of historical maps (Groundsure historical maps in **Annex B**) is presented in **Table 7.2**.

Table 7.2 - Pertinent History Section 6

Mapping Dates	DCO Proposed Development Section and Immediate Surroundings (approximately 250 Buffer)	Wider Surroundings (approximately 1km Buffer)
1870s to 1900s	<p>Earliest available mapping presents agricultural land which is intersected by few residential properties and farmland, surface water features (Northop Brook and many ponds) and highway infrastructure (B5126, carriageways and footpaths). In addition, a unidentified feature, likely sand pit and lime kiln are located approximately 220m west at Llwyn Onn Lane.</p>	<p>The surrounding area, within 1km of the Newbuild Carbon Dioxide Pipeline, is largely agricultural, with isolated residential properties and farmland. The town of Flint is located to the north, Leadbrook Wood and Oakenholt Wood lie to the east, Northop Hall and Northop are located to the South, and the village of Flint Mountain and the A5119 lie to the west. Very limited industrial works are located within 1km of the Newbuild Carbon Dioxide Pipeline (sewage works containing filter bed and tanks from 1898 to present, 640m west at adjacent to the existing A55)</p>
1900s to 1960s	<p>Two areas of surface ground working, identified as sandpits, are identified on historical mapping between 1909 and 1953;</p> <ul style="list-style-type: none"> Between 1909 and 1948 a surface working identified as 'sand pit' appears at Tros-y-mynydd adjacent to Starkey Lane and intersecting the central area of the section; and In 1953 a surface working identified as 'old sand pit' is located 250m east of the Newbuild Carbon Dioxide Pipeline and to the south of Little Leadbrook Farm. <p>Maps dated 1959 are not available for either area of the section and by 1969 both sand pits area is no longer identified, and land has been reverted to undeveloped agricultural land. The former sand pit located at distance also appears to contain a water body.</p> <p>In addition, the sand pit and old lime kiln (220m west at Llwyn Onn Lane) are no longer identified on mapping from 1969 onwards.</p>	<p>Expansion of residential land use and infrastructure at Flint, Northop Hall, Northop and Flint Mountain.</p> <p>The following key features have been identified (north to south):</p> <ul style="list-style-type: none"> Quarry (active between circa 1871 to 1898), 600m northwest on the outskirts of Flint. Coed-onn Filter Bed and reservoir (identified on mapping between circa 1909 to 1953).
60s to present day	<p>No significant changes pertinent to land and soils are identified within the surrounding area of the Newbuild Carbon Dioxide Pipeline and land use remains predominantly agricultural to present day.</p>	

7.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

- 7.3.1. An overview of the extent of Section 6 against geological mapping and a summary of boreholes within this Section are presented in **Annex H**.
- 7.3.2. Made Ground is expected within the Newbuild Infrastructure Boundary and in the immediate surrounding area, associated with existing and historical development (identified in Section 6.2). BGS Mapping (**Ref. 13.1**) identifies superficial deposits comprising Glacial Till along Section 6, with Glaciofluvial deposits encroaching on the eastern boundary. These are further underlain by bedrock comprising the Pennine Coal Measures Formation (Lower and Middle) and Gwespyr Sandstone.

HYDROGEOLOGY

- 7.3.3. The Environment Agency classifies the Glacial Till as a Secondary Undifferentiated Aquifer and Glaciofluvial Deposits as a Secondary A Aquifer. The bedrock deposits are all classified as Secondary A Aquifers.
- 7.3.4. The Section does not lie within, or within 250m of, a source protection zone (SPZ).

HYDROLOGY

- 7.3.5. A summary of the hydrology information for Section 6 is presented in **Table 7.3**, based on information contained within the Groundsure Report in **Annex B**.

Table 7.3 - Section 6 Hydrology Summary

Catchment Areas	Features Identified <250m of proposed pipeline	Details
Operational Catchment: Dee Estuary Management Catchment: Dee Water Body Catchment: Wepre Brook	This section intersects the Northop Brook and falls within 250m of the Lead Brook. Numerous ponds have also been identified within 50m of this section of Newbuild Carbon Dioxide Pipeline.	Northop Brook and Lead brook, located within the Wepre Brook Water Body Catchment which has been classified with the following status' from NRW as of 2021 (most recent evaluation); ecological status of moderate and an overall water body status of moderate. N.B chemical concentrations are not reported.

COAL MINING

- 7.3.6. A review of the Coal Authority Interactive mapping online (**Ref. 13.2**) indicates there are no mine entries or areas of probable shallow mine workings that relate to development high risk areas within Section 6. Coal mining related stability risks are therefore not considered further within this section assessment.

QUARRYING AND MINERAL EXTRACTION

- 7.3.7. A review of the Groundsure report regarding quarrying and mineral extraction in Section 6 is summarised in **Table 7.4**.

Table 7.4 - Summary of Quarrying and Mineral Extraction in Section 6

Feature	Newbuild Carbon Dioxide Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
Surface Ground Workings	As detailed in Section 7.2 Land History, a surface ground working feature relating to a sand pit is identified between 1909 and 1948 at Tros-y-mynydd and intersecting the central area of the section.	Surface ground working features within 250m of the Newbuild Carbon Dioxide Pipeline largely relate to sand pits and unspecified ground workings / pits. Few ponds have also been identified. As detailed in Section 7.2, the identified sand pits relate to ceased surface workings positioned 220m west at Llwyn Onn Lane and 250m east, to the south of Little Leadbrook Farm.
Historical Mineral Planning Areas	N/A	The aforementioned former sand pit located 250m east of the Newbuild Carbon Dioxide Pipeline, to the south of Little Leadbrook Farm is a designated historical mineral planning area. According to the Groundsure Report, this area was worked for sand and gravel.
Non-coal Mining	The Groundsure Report identifies many entries relating to localised small scale and sporadic underground	

Feature	Newbuild Carbon Dioxide Pipeline Section and Immediate Surroundings (100m Buffer)	Wider Surroundings (250m Buffer)
	mining for iron ore (bedded) and vein mineral deposits within 250m of the proposed pipeline.	
Other	<p>None of the following features have been identified within the Study Area / 500m / 1km (as defined) of Section 6;</p> <ul style="list-style-type: none"> • Natural Cavities (within 500m) • Underground Workings (within 500m) • Mining Cavities (within 1km) • Clay and tin mining (within the Newbuild Infrastructure Boundary) • Gypsum and brine extraction areas (within the Newbuild Infrastructure Boundary). <p>The potential risk from the above features is therefore considered to be negligible.</p>	

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

- 7.3.8. A review of the BGS mapping identifies mineral resources comprising primary and secondary shallow surface coal and glaciofluvial deposits along the route of Section 6.

NATURAL GROUND SUBSIDENCE

- 7.3.9. A summary of subsidence risks within Section 6 are present in **Table 7.5**.

Table 7.5 - Summary of Natural Ground Subsidence

Hazard	Rating (50m of Newbuild Carbon Dioxide Pipeline Route)
Shrink Swell Clays	Negligible - very low
Running Sands	Negligible – very low
Compressible Deposits	Negligible – very low
Collapsible Deposits	Very low
Landslides	Very low to moderate (moderate risk along Lead Brook)
Ground Dissolution of Soluble Rocks	Negligible

FLOODING

Surface Water Flooding

- 7.3.10. The entirety of Section 6 appears to lie within Flood Risk Zone 1 defined as *“land having a less than 1 in 1,000 annual probability of river or sea flooding.”*

Groundwater Flooding

- 7.3.11. The risk of groundwater flooding across the entirety of Section 6 is defined as low.

SENSITIVE LAND USES

- 7.3.12. The following sensitive land uses are recorded within 1km of Section 6:
- Designated SSSI associated with Flint Mountain approximately 600m northwest; and,
 - Many records of designated ancient woodland are identified within 1km of Section 6, concentrated along the watercourse of Lead Brook. Two pockets of ancient semi-natural woodland are located to the north of the section and along the eastern boundaries of the 50m pipeline buffer, associated with Leadbrook Wood.

AGRICULTURAL LAND DESIGNATION

- 7.3.13. Section 6 includes Grade 3a (best and most versatile) and Grade 3b agricultural land according to MAGIC Maps (**Ref 13.4**). The Agricultural Land Classification information contained within **Appendix 11-4 (Volume III)** indicates that Section 4 contains a mixture of Grades 2, 3a, 3b and 4.

SOIL TYPE

- 7.3.14. The expected soil types in Section 6 include;

- Loamy and clayey (slightly acid but base-rich) soils across the majority of the section (related to glacial till deposits), which are slowly permeable (impeded drainage to stream network) and seasonally wet, with moderate fertility and low carbon.
- Loamy (slightly acid) soils encroaching on the eastern boundary (related to glaciofluvial deposits), which are freely draining, with low fertility and low carbon.

7.4. IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- SECTION 6

7.4.1. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

7.4.2. A summary of potential sources identified within 250m of Section 6 of the proposed pipeline are presented in Table 7-6 and a spatial plan is included as **Figure 11.1.3 (sheet 6), Annex A.**

Table 7.6 - Section 6 Potential Sources

Source	Contaminants
<p>Made Ground associated with identified land uses (bullet pointed below) or unexpected Made Ground at agricultural land.</p> <ul style="list-style-type: none"> • Historical and existing infrastructure associated with residential land use and farmland (buildings, yards, tracks, and footpaths). • Historical industrial land; surface ground workings (sand pits) and lime kiln. 	Asbestos, heavy metals, polyaromatic hydrocarbons (PAHs) 16, total petroleum hydrocarbons criteria working group (TPH CWG), volatile organic substances (VOCs) and semi-volatile organic substances (SVOCs).
Made Ground associated with infilled historic ground workings, pits and ponds.	Asbestos, heavy metals, PAH 16 and TPH CWG
Highway land	Asbestos, heavy metals, PAH 16 and TPH CWG
Hazardous gases associated with infilled land, Made Ground, historic ground workings.	Carbon dioxide, methane and hydrogen sulphide

Source	Contaminants
Underlying bedrock (generally less than 1% of properties affected by radon, although there are areas, particularly in the north, where the radon action level increases to over 30%)	Radon

PATHWAYS

- Direct contact, ingestion or inhalation of fibres or vapours;
- Inhalation of hazardous gases or vapours;
- Accumulation of hazardous gases (asphyxiation and explosive risk);
- Overland flow of groundwater;
- Lateral migration via unnamed streams and watercourses;
- Leaching of contaminants via the unsaturated zone into shallow groundwater;
- Vertical migration into superficial and bedrock aquifer; and
- Baseflow of groundwater to surface water features.

RECEPTORS

Human Health

- Construction workers during the construction phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e., dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;
- Deeper groundwater within bedrock; and
- The surrounding water network, Northop Brook, Lead Brook and Pentre Brook.

Environmentally Sensitive Sites

- Flora and fauna within the nearby environmentally sensitive sites (i.e., SSSI's and designated ancient woodland).

Mineral Resources

- Identified mineral resources comprising primary and secondary shallow coal and glaciofluvial deposits located along the route of Section 6.

Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

8. SECTION 7

8.1. DESCRIPTION AND CURRENT USE

- 8.1.1. An overview of the Block Valve Stations can be seen on **Figure 11.1.2 (sheet 7)** and **Figure 11.1.4 (sheets 1-3), Annex A** and pertinent details are summarised in **Table 8.1**.

Table 8.1 - Description of Section 7

Item	Babell BVS	Pentre Halkyn BVS	Cornist Lane BVS
Location	Approximately 300m west of Plas-Newydd Farm off Racecourse Lane located approximately 900m northwest of Babell in North Wales.	Immediately west of the B5121 Allt Y Chwiler. Approximately 50m north of junction with Ffordd Babell and approx.2.7km west of the village of Pentre Halkyn.	Immediately south of Cornist Lane with a farm labelled as Bryn Awel is immediately adjacent to the east and Junction 32 of the North Wales Expressway is 1.75km northwest.
Area	Approximately 3.04ha	Approximately 3.14ha	Approximately 2.57ha
National Grid Reference	314873, 374534	317361, 373282	321701, 372569
Description of Current Land Use	Agricultural land accessible via Racecourse Lane to the west and an unnamed footway/single track lane that runs parallel to the northern boundary.	Agricultural land accessible via an unnamed track off the B5121 Allt Y Chwiler to the west.	Agricultural land accessible via an unnamed track off Cornist Lane.
Surrounding Area	Agricultural land and farms.	Surrounded by agricultural land. The B5121 is immediately west, and a crossroads immediately to the southwest, with Ffordd Babell road to the west northwest and Ffordd Groes road to the southeast. Farms are located across adjacent roads to the west and south of proposed tree planting areas. There is a farm located approximately 130m northeast, Gelli Fowler Farm approximately 250m northwest and Groesfford Farm approximately 150m south.	Woodland approximately 150m southwest, agricultural land with residential dwellings and farms. A small farm labelled as Bryn Awel is immediately east. A larger farm labelled as Lleprog Farm is approximately 100m north.

Item	Babell BVS	Pentre Halkyn BVS	Cornist Lane BVS
Elevation and Topography	Approximately 175m AOD	Approximately 207m AOD	Approximately between 133m AOD

8.2.

HISTORY

8.2.1.

A review of pertinent history is presented in **Tables 8.2** to **Table 8.4**.

Table 8.2 - Pertinent History Babell BVS

Mapping Dates	Within Block Valve Boundary	Wider Surroundings (250m)
1870 - 1871	Earliest available mapping (1870) shows an 'Old Quarry'. However on 1871 mapping, the area is shown as agricultural land. An unlabelled road crosses south to east in the northwest.	The following features have been identified within 250m: <ul style="list-style-type: none">• A 'Well' approximately 150m to the east;• 'Old Limekiln' approximately 165m southeast;• 'Old Sand Pit' approximately 250m southeast;• 'Two 'Old Lead Shafts' approximately 250m southeast and approximately 310m northwest.
1900 – 1950s	No significant changes are noted on-site or within the surrounding area.	
1960s to present day	On 1989 to 1992 mapping a track is shown crossing east to west.	By 1968 – 1969 mapping: <ul style="list-style-type: none">• 'Old Lead Shaft' to the west is 'Disused'• Quarry, lime kiln, sand pit and 'Old Lead Shaft' to the east are no longer shown.• A works is approximately 200m southwest, after 1989 it is labelled as an 'Electrical Substation'.

Table 8.3 - Pertinent History Pentre Halkyn BVS

Mapping Dates	Within Block Valve Boundary	Wider Surroundings (250m)
1870 - 1900	Agricultural land intersected north to south by a track.	Numerous lead shafts and wells have been identified within 250m in all directions. The closest is in the north-eastern corner of the BVS. 1898 and 1900 maps show a 'Clay Pit' approximately 120m to the southwest and many of the shaft are labelled as 'Old'.
1900 – 1950s	No significant changes are observed.	No significant observations within 250m.
1960s to present day		By 1969 mapping, all shafts/ the limekiln as labelled as 'Disused'. A farm is shown in the immediate surroundings to present day.

Table 8.4 - Pertinent History Cornist Lane BVS

Mapping Dates	Within Block Valve Boundary	Wider Surroundings (250m)
1871 - 1900	Earliest mapping (1871) shows a small structure, in the east of but the remainder comprises undeveloped land. By 1898, a road is present crossing southwest to northeast.	Predominantly agricultural land and numerous 'Wells' are noted within 250m.
1900 – 1950s	The small structure is no longer shown in 1909 and 1910. By 1948 two wells are shown.	1909 an 'Air Shaft' is approximately 260m west and two quarries, connected by a 'Tramway' are approximately 300m to the southwest.
1960s to present day	No significant changes noted.	By 1969 the 'Air Shaft' to the west is labelled as 'Disused' but no other significant changes are noted within the wider surroundings.

8.3. ENVIRONMENTAL SETTING

GEOLOGICAL SETTING

8.3.1. An overview of Section 7 against geological mapping and a summary of boreholes within these areas are presented in **Annex H**.

- Babell BVS: There is potential for Made Ground beneath the lane that runs through the area. Made Ground would not be expected within remainder used for agricultural purposes. BGS mapping indicates superficial deposits comprising Glacial Till (mixture of clay, silt, sand, gravel and boulders) in the northwest, Glaciofluvial Deposits (sand and gravel) in the centre and Head Deposits (poorly sorted angular rock debris and or clayey hillwash and soil creep) in the southeast. These are further underlain by bedrock comprising the Cefn Mawr Limestone.
- Pentre Halkyn BVS: Made Ground relating to the roadway or surrounding farm activities may be underlying the Babell BVS, however significant thicknesses of Made Ground are not expected. BGS Mapping indicates that superficial deposits comprise Glacial Till across the Pentre Halkyn BVS and Glaciofluvial Deposits across part of the north of Pentre Halkyn BVS. These are underlain by bedrock comprising the Loggerheads Limestone Formation.
- Cornist Lane BVS: Made Ground relating to the nearby farm may potentially be present, however significant depths of Made Ground are unlikely. BGS Mapping indicates that Glacial Till is recorded in the northeast of Cornist Lane BVS , with superficial deposits absent from the rest of Cornist Lane BVS . The bedrock underlying the Cornist Lane BVS comprises the Bowland Shale Formation and the Gwespyr Sandstone Formation in the east and west.

HYDROGEOLOGY

8.3.2. The Environment Agency classifies aquifer status of Section 7 as summarised in **Table 8.5**.

Table 8-5 – BVS hydrogeology units and aquifer designations

BVS	Aquifer Type	Geological Unit
Babell BVS	Secondary Undifferentiated	Glacial Till
	Secondary A	Glaciofluvial Ice Contact Deposits
	Secondary Undifferentiated	Head
	Principal	Cefn Mawr Limestone
Pentre Halkyn BVS	Secondary Undifferentiated	Glacial Till
	Secondary A	Glaciofluvial Ice Contact Deposits
	Principal	The Loggerhead Limestone
Cornist Lane BVS	Secondary Undifferentiated	Glacial Till
	Secondary Undifferentiated	The Bowland Shale
	Secondary A	The Gwespyr Sandstone

8.3.3. The BVSs do not lie within, or within 250m of, source protection zones (SPZs).

8.3.4. There was a historical groundwater abstraction 170m northeast of BVS2 for farming. There are no other records of groundwater abstractions within the block valve sites boundaries or within 500m of the block valve sites.

HYDROLOGY

8.3.5. A summary of the hydrology information for BVSs is presented in **Table 8.6**.

Table 8-6 - Hydrology Summary for BVS Sites in Section 7

BVS	Catchment Areas	On-site or within 250m	Details
Babell BVS	Operational Catchment: Clwyd Lower Management Catchment: Clwyd Water Body Catchment: Wheeler - Lower	The Afon Wys river is located 380m south. Unnamed Land Drain situated approximately 660m east.	The lower Wheeler is a designated river approximately 3km south of Babell BVS. Water quality data reported within the Groundsure report indicates that water quality was of 'moderate' ecological quality and 'good' chemical quality with an

BVS	Catchment Areas	On-site or within 250m	Details
			overall classification of 'moderate' for water quality in 2016.
Pentre Halkyn BVS	Operational Catchment: Clwyd Lower Management Catchment: Clwyd Water Body Catchment: Pant-gwyn (Wheeler)	No features within 1km.	The Pant-gwyn (Wheeler) is a designated river approximately 1.8km southwest of Pentre Halkyn BVS. Water quality data reported within the Groundsure report indicates that water quality was of 'good' ecological quality and 'good' chemical quality with an overall classification of 'good' for water quality in 2016.
Cornist Lane BVS	Operational Catchment: Dee Estuary Management Catchment: Dee Water Body Catchment: Swinchiard Brook	Afon Nant-y-Fflint located approximately 160m west, with several small unnamed drains located to the further west. Small unnamed drain located approximately 110m northeast. Unnamed pond located approximately 385m to the north.	The Swinchiard Brook is a designated river approximately 1.2km south. Water quality data reported within the Groundsure report indicates that water quality was of 'good' ecological quality and 'good' chemical quality with an overall classification of 'good' for water quality in 2016.

COAL MINING

- 8.3.6. A review of the Coal Authority Interactive mapping online (**Ref. 13.2**) indicates Babell BVS and Pentre Halkyn BVS are outside the Coal Mining Reporting Area. Cornist Lane BVS is within the Coal Mining Reporting area however there are no mining features within the site.

QUARRYING AND MINERAL EXTRACTION

- 8.3.7. A review of the Groundsure report regarding quarrying and mineral extraction near the BVSs is summarised in **Table 8.7**.

Table 8-7 - Summary of Quarrying and Mineral Extraction

Feature	On-site	Within 250m
Brit Pits	None recorded within site boundaries of any of the BV sites.	<p>Babell BVS - Ceased underground lead working at Bryn-llwyn approximately 250m southeast.</p> <p>Pentre Halkyn BVS –</p> <ul style="list-style-type: none"> • Gelli-ffowler former lead shaft approximately 25m north • Groesffordd Farm former lead shaft approximately 95m south • Glanllyn-chaf former lead shaft approximately 230m northwest of BVS2. <p>Cornist Lane BVS - Two pits associated with sandstone extraction from the Windmill site approximately 165m southwest and Cornist Ganol site located approximately 190m southwest of Cornist Lane BVS.</p>
Surface Ground Workings	<p>Babell BVS - ‘Old quarry’ shown in southwest of site on earliest historical mapping from 1870, after 1870 mapping it is no longer labelled.</p> <p>No other surface ground workings recorded within Red Line Boundary of any of the other BVS sites.</p>	<p>One unspecified quarry identified approximately 160m southeast of the Babell BVS and numerous unspecified pits/heaps identified within 250m. Former quarry 348m northwest.</p> <p>Numerous ponds, clay pots and unspecified pits, workings and heaps identified within 250m of Pentre Halkyn BVS. There is an unnamed quarry operated by CCP aggregates located 1.1km</p>

Feature	On-site	Within 250m
		<p>east, Halkyn Quarry operated by Cemex is 1.4km southeast.</p> <p>Cuttings, ponds and unspecified quarries/pits have also been identified within 250m of Cornist Lane BVS.</p>
Underground Workings	None recorded within Red Line Boundary of any of the BVS sites.	<p>Two unspecified old shafts identified within 250m of Babell BVS, the closest of which is approximately 230m northwest. The Groundsure report indicates the northwest part of Babell BVS is within an area where localised small scale underground mining is possibly related to a former limestone quarry 348m northwest.</p> <p>Numerous old/disused unspecified and lead shafts identified within 250m of Pentre Halkyn BVS site. Closest recorded is the former lead working located 25m north (Brit Pit Section). Pentre Halkyn BVS is within an area where underground mining is known or likely within close proximity related to the Brit Pits mentioned above.</p> <p>None recorded within 250m of Cornist Lane BVS. Cornist Lane BVS is within an area where sporadic underground mining of a restricted extent is possible.</p>

Feature	On-site	Within 250m
Mining Cavities	None recorded within Red Line Boundary of any of the BVS sites.	<p>Bryn-Llwyn lead mine located approximately 190m southeast of Babell BVS has been identified as a mining cavity within 250m.</p> <p>Two cavities have been identified within 250m of Pentre Halkyn BVS (approximately 110m north and 190m northeast associated with the Gelli Fowler lead workings).</p> <p>None have been recorded within 250m of Cornist Lane BVS.</p>

FUTURE MINERAL EXTRACTION – MINERAL RESOURCE AREA

8.3.8. A review of the BGS Mineral Resources Map of Wales shows the following Mineral Resources beneath the proposed BVS sites:

- Babell BVS: Sand and Gravel resource (Glaciofluvial Deposits) beneath part of the site and High Purity Limestone beneath the entire site.
- Pentre Halkyn BVS: Sand and Gravel resource (Glaciofluvial Deposits) beneath part of the site and Limestone beneath the entire site.
- Cornist Lane BVS: None recorded.

NATURAL GROUND SUBSIDENCE

8.3.9. A summary of subsidence risks within BVS sites are presented in **Table 8.8**.

Table 8-8 - Summary of Natural Ground Subsidence

Hazard	Babell BVS	Pentre Halkyn BVS	Cornist Lane BVS
Shrink Swell Clays	Very low risk	Very low risk	Very low risk
Running Sands	Very low risk	Low risk	Low risk
Compressible Deposits	Negligible risk	Moderate risk	Moderate risk
Collapsible Deposits	Very low risk	Very low risk	Very low risk
Landslides	Very low risk	Low risk	Moderate risk
Ground Dissolution of Soluble Rocks	Low risk	Moderate risk	Moderate risk

FLOODING

Surface Water Flooding

- 8.3.10. A review of data presented on the Development Advice Map by Natural Resources Wales, all three BVS sites lie within Flood Zone A areas defined as *“at little or no risk of fluvial or coastal/tidal flooding”*.

Groundwater Flooding

- 8.3.11. All three BVS sites are at low risk from groundwater flooding with the exception of Cornist Lane BVS which spans between negligible and low risk.

SENSITIVE LAND USES

- 8.3.12. The following sensitive land uses are recorded at BVS sites:
- All three BVS sites are located within a SSSI Impact Risk Zone, thought to be related to the Dee Estuary. The development proposals for the BVS sites do not require consultation for the particular sensitivities of the zone.

AGRICULTURAL LAND DESIGNATION

- 8.3.13. All three BVS sites are within Grade 3a agricultural land (good quality and high sensitivity) according to MAGIC Maps (**Ref 13.4**). The information included in **Appendix 11-5 (Volume III)** indicates that Section 7 contains a mixture of Grade 2 and 3a land.

SOIL TYPE

- 8.3.14. The Cranfield Soil and Agri-food Institute Soilscales website (**Ref. 13.7**) defines the following soil quality classifications to the areas:
- 8.3.15. Babell BVS & Pentre Halkyn BVS: Slightly acid but base-rich soils with a loamy texture. Soils are freely draining to the underlying groundwater. Habitats

comprise base-rich pastures and deciduous woodland with arable and grassland landcover. Soils have low carbon and high fertility.

- 8.3.16. Cornist Lane BVS: Slightly acid but base-rich loamy and clay soils with loamy and clayey texture. Soils are slowly permeable and seasonally wet, with impeded drainage to the stream network. Habitats comprise seasonally wet pastures and woodlands with grassland and arable (some woodland) landcover. Soils have low carbon and moderate fertility.

8.4. IDENTIFIED SOURCES-PATHWAYS-RECEPTORS- BVS SITES

8.4.1. A summary of pertinent sources, pathways and receptors that will be carried over to the preliminary conceptual model (presented in Section 10) are presented below:

SOURCES

8.4.2. The potential sources of contamination are considered to be the following:

- Contaminants of concern relating to the lead mining in the vicinity of Babell BVS and Pentre Halkyn BVS eg. heavy metals;
- Contaminants of concern relating to Made Ground eg. related to former quarry identified on Babell BVS, unidentified areas of Made Ground associated with agricultural activities;
- Hazardous gases associated with thicknesses of Made Ground, if present, related to the old quarry (Babell BVS) and nearby former lead mines (Babell BVS/ Pentre Halkyn BVS). Eg. Carbon dioxide, methane and hydrogen sulphide; and
- Naturally occurring moderate to high radon levels (up to 30%).

PATHWAYS

- Direct contact, ingestion and inhalation of soil-bound contamination / dust;
- Inhalation of vapours associated with volatile soil / groundwater contamination;
- Migration of mobile / leachable contamination through soils / shallow groundwater to the underlying superficial or bedrock aquifer or surface waters;
- Migration of hazardous ground gases and build-up in confined spaces (e.g., excavations, below ground chambers etc) resulting in asphyxiation or risk of explosion; and
- Direct contact between contaminants and buried services or infrastructure.

RECEPTORS

Human Health

- Construction workers during the construction phase;
- Neighbouring site users, nearby residential properties or members of the public (i.e. dog walkers) during the construction phase; and
- Pipeline workers and maintenance workers during the operational phase.

Controlled Waters

- Shallow groundwater within superficial deposits;

- Deeper groundwater within bedrock; and
- The tributaries of the Afon Nant-y-Fflint and unnamed water courses.

Environmentally Sensitive Sites

- Flora and fauna within the nearby environmentally sensitive sites (i.e. SSSI's).

Built Environment

- Newbuild Carbon Dioxide Pipeline infrastructure and buildings.

9. REGULATORY INFORMATION

9.1. REGULATORY DATABASE

- 9.1.1. A review of regulatory information contained within the Groundsure Enviro Insight Report (**Annex B**) was undertaken. A summary of pertinent regulatory information for Sections 1 to 6 of the DCO Proposed Development and Section 7 (BVS sites) is presented in **Table 9.1** and **Table 9.2** respectively.

Table 9.1 – Summary of Pertinent Regulatory Information for Sections 1 to 6

Information	Within NIB / within 50m	Within 250m	Details of Pertinent Sites
Control of Major Accident Hazards (COMAH)	3	3	<p>Current</p> <p>Section 1: 2no. Upper Tier COMAH sites associated with the Stanlow Manufacturing Complex and CF Fertilisers. 1no. offsite Upper Tier COMAH site 213m west for Avanti Gas Limited.</p> <p>Section 4: 1no. offsite Upper Tier COMAH site 138m northeast for an agricultural chemical works (FMC Agro Limited).</p> <p>Historical</p> <p>Section 1: 1no. unidentified tier COMAH site associated with the Essar Stanlow Manufacturing Complex.</p> <p>Section 4: 1no. offsite Upper Tier COMAH site 138m northeast for an agricultural chemical works (Headland Agrochemicals Limited).</p>
Hazardous Substance Storage / Usage	3	7	<p>Current</p> <p>Section 1: 1no. entry associated with United Utilities Waste Management.</p> <p>Section 2: 1no. offsite entry 117m north associated with CLH Pipeline System Ltd.</p> <p>Section 4: 1no offsite entry 171m northeast associated with FMC Agro Ltd.</p> <p>Historical</p> <p>Section 1: 2no entries associated with industrial land uses; petrol station and Stanlow Manufacturing Complex. 5no offsite entries associated with various industrial uses; CF Fertilisers, Kemira Fertilisers, Stanlow Manufacturing Complex etc.</p>
Licensed Discharge to Controlled Waters	17	35	<p>Identified entries relate to discharge of final / treated sewage from isolated farms, sewer storm overflow, trade discharges (process / treated effluent and standing water) and miscellaneous emergency discharges.</p> <p>Effective</p> <p>18 no. entries (2no. entries on site, none within 50m, remainder within 250m).</p> <p>Revoked / expired</p> <p>34 no. entries (7no. entries on site, 8no. entries within 50m, remainder within 250m).</p>
Active / Recent Landfill Sites (EA / NRW)	0	2	<p>Section 2: Gowy Landfill is an active landfill site with a capacity of >25,000 tonnes, located approximately 150m south / southeast of the proposed pipeline (at its closest point) to the west of Wimbolds Trafford.</p> <p>Section 5: Old Aston Hill Landfill is a recently active landfill (type A6), accepting 'other' wastes during operation, located 100m north of the proposed pipeline in Ewloe.</p>
Historical Landfill Sites (BGS/ LA / EA / NRW Records)	5	4	<p>Historical landfills within 50m of the Newbuild Carbon Dioxide Pipeline;</p> <p>Section 2: 3no historical landfill sites;</p> <ul style="list-style-type: none"> • Thornton Green Landfill (located centrally, to the north of the M56) accepting inert waste during operation. • Spring Bank Farm (located centrally, to the south of the M56) accepting inert waste during operation.

Information	Within NIB / within 50m	Within 250m	Details of Pertinent Sites
			<ul style="list-style-type: none"> Land off Station Road (located centrally, to the east of the south-bound carriageway of the A41 Liverpool Road) accepting inert waste during operation. <p>Section 5: 2no. historical landfill sites;</p> <ul style="list-style-type: none"> New Bridge Farm (located centrally, southeast of Northop Hall) accepting inert and commercial waste during operation. Unidentified historic landfill (located centrally, to the west of the north-bound carriageway of the A550 Gladstone Way) accepting inert waste during operation. <p>Historical landfills within 250m of the Newbuild Carbon Dioxide Pipeline;</p> <p>Section 1: Ince Power Station, 230m west in Elton.</p> <p>Section 4: Refuse tip, 60m south at the existing Greenacres Animal Park in Mancot.</p> <p>Section 5: 2no. unidentified landfills; A) unidentified landfill, 200m south at Upper Aston Hill Lane in Ewloe, accepting inert, industrial, commercial, household and special waste during operation; B) unidentified landfill, 90m north at the existing scrap yard at Old Aston Hill in Ewloe, accepting inert, commercial and industrial wastes during operation.</p>
Licenced Waste Sites	2	2	<p>Licenced waste sites within 50m of the Newbuild Carbon Dioxide Pipeline;</p> <ul style="list-style-type: none"> Section 3: 2no. entries 50m north to the west of the north-bound carriageway of the A41 Liverpool Road in Backford associated with surrendered household, commercial and industrial waste. <p>Licenced waste sites within 250m of the Newbuild Carbon Dioxide Pipeline;</p> <ul style="list-style-type: none"> Section 5: 2no. entries 90m north at the existing scrap yard at Old Aston Hill in Ewloe associated with effective metal recycling site and closed household, commercial and industrial waste landfill (see above 'Historical Landfill Sites' for detail).
Waste Exemptions	14	48	Exemption records within 50m of the Newbuild Carbon Dioxide Pipeline are concentrated along Sections 1, 2 and 3 and relate largely to the storage of sludge at farms. Other waste exemptions identified within 50m of the proposed pipeline also include spreading, burning and use of waste in construction.
Pollution Incidents	12	169	Pollutant Incidents recorded within 50m of the Newbuild Carbon Dioxide Pipeline are concentrated along Sections 4 and 5 and relate to inert mineral waste (soil / clay), agricultural materials / waste, commercial waste, noise, odour, minewater and blood / offal. Impacts of the pollutant incidents on water, land and air within 50m of the proposed pipeline were classified as Category 4 (no impact) or Category 3 (minor impact).
Historical Tanks	49	161	The majority of historical tanks located within 50m of the Newbuild Carbon Dioxide Pipeline (35 of 49 identified) lie along Section 1 and are associated with Stanlow Oil Refinery. The 14 remaining tanks are located along Sections 4, 5 and 6; no specific details on tank usage or capacity is contained within the Groundsure Report.
Historical Military Land	1	N/A	ROF Dunham-on-the-Hill identified along Section 1 (between A5117 Hill View Way and M56) and used for the storage and distribution of explosives during WWII. Following WWII, the area was used for the storage of shells including phosphor bombs.
Historical Energy Features	6	35	6no. historical electricity substations have been identified within 50m of the Newbuild Carbon Dioxide Pipeline, along Sections 1, 2 and 5. Three of the six are located along Section 1 and two have the potential of containing PCB's (pre 1986).

Information	Within NIB / within 50m	Within 250m	Details of Pertinent Sites
Historical Garages / Petrol Stations	2	11	<p>Within 50m of the Newbuild Carbon Dioxide Pipeline, the following historical land uses have been identified along Section 1 and Section 5 (respectively) 1no. historical garage (adjacent to west-bound carriageway of the A5117 Hill View Way in Elton) and 1no. filling station (Chester West Services, accessed via east-bound A55 carriageway, south of Northop Hall).</p> <p>Within 250m of the Newbuild Carbon Dioxide Pipeline, 2no. historical filling stations have been identified along Section 5 and 9no. historical garages have been identified along Sections 2, 3, 4 and 5 (with the majority of historical garages concentrated along Sections 4 and 5).</p>
Current / Recent Petrol Stations	2	5	<p>2no. current / recent petrol stations have been identified within 50m of the Newbuild Carbon Dioxide Pipeline, only one of which is open; Dragon Petroleum petrol station adjacent to Newbridge Farm located along Section 5.</p> <p>5no. current / recent petrol stations have been identified within 250m of the Newbuild Carbon Dioxide Pipeline, two of which are closed / obsolete and the reminder open and accessed via the M56 (Section 1) and A55 (Section 5).</p>
Historical Contaminative Trades	N/A	N/A	Following a review of historical mapping provided within the Groundsure Report, numerous potentially contaminative trades have been identified along the Newbuild Carbon Dioxide Pipeline route. Please refer to earlier Land Use History Sections for detailed information.
Current / Active Contaminative / Industrial Trades	N/A	N/A	<ul style="list-style-type: none"> Section 1: Contaminative industrial trades including the Stanlow Manufacturing Complex, CF Fertilisers Plant and Ince Bio Power Station. Sections 2 to 6: Numerous potentially contaminative trades have been identified within 250m of the Newbuild Carbon Dioxide Pipeline including industrial business parks / estates, garages and service stations, a scrap yard and Alltami Clay Quarry. Many of these features are concentrations along Sections 5 and 6.
Water Abstractions (groundwater and surface water)	1	5	<ul style="list-style-type: none"> Section 1: 1no. active groundwater abstraction point at Pool Lane, located 42m north (used as process water and for general cooling, boiler feed, use relating to secondary category and commercial / industrial / public services including drinking, cooking, sanitary and washing). Section 2: 2no. active surface water abstraction points within 250m; A) abstraction point at the Shropshire Union Canal at Backford Oil Depot, located 147m northeast (used for general use relating to secondary category) and B) abstraction point at the Gowy Meadows, located 196m north (used for transfer between sources). Section 4: 2no. historical groundwater abstraction points within 250m; A) abstraction point for process water, 222m north and B) abstraction point for spray irrigation, 50m east. The latter activity also has an active consent to utilise surface water from the Sealand Main Drain, located within 50m of the Newbuild Carbon Dioxide Pipeline. Section 5: 1no. historical groundwater abstraction (used for drinking water) 190m northwest.

Table 9.2 – Summary of Pertinent Regulatory Information for Section 7

Information	On-site	Within 250m	Details
Waste Exemptions	0	2	Related to the storage of sludge on farms less than 200m to Cornist Lane BVS.
Historical Tanks	0	1	Unspecified tank located approximately 130m south of Pentre Halkyn BVS
Historical Energy Features	0	1	Electrical substation recorded 227m southwest of Babell BVS.
Current/Active Contaminative Trades	1	N/A	Pylon within boundary of Babell BVS Active dairy farm located approximately 190m northeast of Pentre Halkyn BVS.
Water Abstractions	0	1	One historical groundwater abstraction 170m northeast of Pentre Halkyn BVS.

9.2. CONTAMINATED LAND REGISTERS

- 9.2.1. An email requesting a review of the contaminated land register was sent to Environmental Protection at Chester and Cheshire West (CWAC). A review of the contaminated land registers available on the Flintshire Council website (**Ref. 13.8**) indicates that there are no site designated as Contaminated Land under Part 2A within 250m of the Scoping Boundary within the parts of Section 4, 5 and 6 that lie within their jurisdiction.

9.3. RADON

- 9.3.1. A summary of pertinent radon information from a review of the Groundsure Report in **Annex B** and the Public Health England Radon Website (**Ref. 13.9**) is presented in **Table 9.3**.

Table 9-3 – Summary of Radon Information

Associated Newbuild Infrastructure Boundary Section	Radon Data	Radon Protection Measures required in Buildings
Section 1	Less than 1% of properties at or above action level	No
Section 2	Less than 1% of properties at or above action level	No
Section 3	Generally less than 1% properties affected by radon, although to the immediate east of the England – Wales border, radon action level increases to between 1% -3%.	No
Section 4	Generally less than 1% of properties affected by radon, although to the north of Mancot and in Sandycroft, radon action level increases to between 1% - 10%.	No
Section 5	Generally between 5 – 30% of properties affected by radon, although there are areas along Section 5 where radon action level increases to greater than 30%.	Yes*
Section 6	Generally less than 1% of properties affected by radon, although there are areas, particularly in the north, where the radon action level increases to over 30%	Yes*
Section 7	Generally between 5 – 30% of properties affected by radon, although there are areas along Section 5 where radon action level increases to greater than 30%.	Yes*

*Radon protection measures are only required in buildings were radon action levels exceed 10%.

9.4. UNEXPLODED ORDNANCE (UXO)

- 9.4.1. Preliminary Risk Assessments completed by Zetica and commissioned for the DCO Proposed Development identified the following military land uses / activities from World War I (WWI) and World War II (WWII) along Sections 1 to 6. These can be found in **Annex C**.

World War I

- Williams and Robins Prisoner of War camp and subsequent His Majesty's Explosives Factory (HMEF) Queensferry (located at Grid Reference SJ 322682, 600m north of proposed pipeline along Section 4);
- HMEF at Sandycroft (located at Grid Reference SJ 341672, 670m southeast of proposed pipeline along Section 4); and
- Royal Flying Corps (RFC) Shotwick (no Grid Reference provided by Zetica, however Shotwick is located 3.8km northwest of Section 3)

World War II:

- Queensferry Ordnance Storage Depot (previously HMEF Queensferry);
- Civil Reserve Depot Backford (aviation fuel depot, located at Grid Reference SJ 412717, 320m north at the existing GPSS Backford South along Section 2;
- RAF Hawarden (producing bomber aircrafts, located at Grid Reference SJ 348644, 2km southeast at the existing Airbus UK East Factory along Section 4);
- RAF Sealand (located at Grid Reference SJ 342681, 980m west along Section 4);
- Royal Ordnance Factory (ROF) Dunham-on-the-hill Depot (stored explosives, located at Grid Reference SJ 466739, within the footprint of the Study Area and between A5117 Hill View Way and M56, along Section 1);
- Anti-invasion defences established in close proximity to the Study Area;
- Fighter and bomber aircraft crashed in close proximity to the Study Area;
- A WWII bombing decoy known as "Starfish" was established to imitate central Liverpool. An additional decoy, adjacent, was used to imitate Stanlow Manufacturing Complex; and
- Several HE bombs fell in close proximity to the Study Area.

- 9.4.2. Whilst many WWI and WWII military activities have been identified Zetica concluded that the Newbuild Infrastructure Boundary has a low UXO hazard level and no significant sources of UXO hazard have been identified within the Proposed Development Study Area.

- 9.4.3. As such, Zetica recommended that a formal UXO awareness briefing is provided to all personnel involved in excavations so that they can take the appropriate action in the event of a suspect find.
- 9.4.4. No readily available information indicating the BVS sites in Section 7 were bombed pre, during or post WWI or WWII was found by Zetica so it was concluded that whilst always prudent, a detailed desk study was not considered essential in this instance.

10. PRELIMINARY CONCEPTUAL MODEL

10.1. INTRODUCTION

- 10.1.1. This section of the report presents the characteristics of the Proposed Development Study Area and provides a systematic indication of the risks to enable uncertainties and further assessment needs or other actions to be identified. It draws on the information presented in earlier sections of the report to identify plausible source-pathway-receptor contaminant linkages in the context of the proposed development.

10.2. METHODOLOGY

- 10.2.1. The assessment followed a risk-based approach; with the potential environmental risk assessed qualitatively using the 'source-pathway-receptor' contaminant linkage concept introduced in the guidance documents (principally the EA's Land Contamination Risk Management) on the practical implementation of the Environmental Protection Act 1990.
- 10.2.2. The following assumptions have been made as part of this assessment:
- The finished footprint of the pipeline will be relatively narrow relative to the buffers adopted within this conservative assessment;
 - The pipeline is not considered to pose as a significant source of contamination;
 - Operational risks to human health should be limited by the implementation of maintenance and monitoring of in-built protective measures (e.g. leak detection systems); and
 - Operational phase hazards (i.e., flammable/explosives risks) have not been accounted for within this assessment.

10.3. PRELIMINARY CONTAMINANT LINKAGE ASSESSMENT

- 10.3.1. The source, pathways and receptors that were identified within each Section and the BVS sites are recorded at the end of the relevant chapters.
- 10.3.2. This information has been used in Table 10-1 which provides an evaluation of the potential contaminant linkages associated with proposed future redevelopment on the basis of the information currently available.
- 10.3.3. The assessment has been produced in accordance with CIRIA C552 risk appraisals methodology included in **Annex F**.

Table 10-0.1 – Potential Contaminant Linkages

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
<p>Contamination within Made Ground or natural soils associated with current or historic industrial / commercial land use including oil refineries, fertilisers plants, landfills, collieries, railway embankments.</p> <p>Historical mineral workings and infilled land (coal, lead, sand and gravel);</p> <p>Various historic and current / active industrial trades;</p> <p>Historical military land use; and</p> <p>Isolated electrical substations and / or diesel-powered generators and associated tanks (e.g., supplying rural domestic / farm demands).</p>	<p>Dermal contact, ingestion and inhalation of dusts and / or fibres.</p>	<p>Construction workers during construction phase and decommissioning phase;</p> <p>Maintenance workers / pipeline workers during the operational phase; and</p> <p>Neighbouring site users / members of the public nearby during the construction phase</p>	Medium	Low	<p>MODERATE / LOW RISK</p> <p>Numerous areas of potential contamination sources have been identified within the Newbuild Infrastructure Boundary.</p> <p>A ground investigation targeting the identified sources should be undertaken to qualify and quantify potential risks to future site users during operation (at the time of the original reporting a ground investigation had not been undertaken, however a ground investigation has since been undertaken and is included as Appendix 11-5:to Chapter 11 (Land and Soils).</p> <p>This data will be utilised to produce the risk assessment and method statements for construction workers during the construction phase.</p> <p>Future site maintenance workers should undertake risk assessments related to proposed activities and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline.</p> <p>Prior to the construction phase, a suitable Remediation Strategy will be prepared (if required) to detail the removal and disposal of any soil / groundwater. In addition, an Outline Construction Phase Environmental Plan (OCEMP) has been prepared to detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation.</p>
	<p>Inhalation of hazardous ground gases / vapours.</p>	<p>Construction workers during construction phase and decommissioning phase;</p> <p>Maintenance workers / pipeline workers during the operational phase; and</p> <p>Neighbouring site users / members of the public nearby during the construction phase (if contamination is mobilised during the construction phase)</p>	Medium	Low	
	<p>Overland flow;</p> <p>Lateral migration within on-site surface water features;</p> <p>Leaching of contaminants through the unsaturated zone and subsequent impact on groundwater;</p>	<p>Underlying groundwater (aquifer sensitivity identified within each chapter);</p> <p>On and off-site surface water features (identified for each section within relevant chapters); and</p> <p>Flora and fauna within identified environmentally sensitive sites (i.e., SSSIs).</p>	Medium	Low	<p>MODERATE / LOW RISK</p> <p>Numerous sensitive controlled waters receptors have been identified including sensitive superficial and bedrock deposits, surface water courses and ponds.</p> <p>A targeted ground investigation to establish the baseline groundwater and immediately adjacent surface water course conditions prior to the construction of the DCO Proposed Development should be undertaken.</p> <p>Should significant existing groundwater or surface impact be identified then a suitable remediation strategy should be produced and remedial measures undertaken. Mitigation measures will be required during construction (detailed in the OCEMP) and operation (within the design of</p>

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
	Impact to groundwater via poor quality drainage; Vertical migration to underlying superficial and bedrock aquifers; Baseflow contribution of groundwater to surface water features; and Migration along pipeline once installed.				drainage and pipeline trench design) to prevent the mobilisation and migration of this impact. As the pipeline could act as a preferential pathway an assessment of the long-term effects on the local water regime should be undertaken using the ground investigation data. The CEMP should detail the proposed dewatering methods and mitigation measures for prevention of construction drainage or spillages from impacting nearby water courses or the groundwater.
	Direct contact with corrosive substances (e.g., sulphates and hydrocarbons) in the soil and shallow groundwater; and Accumulation of hazardous gases within structures (explosive risk).	Pipeline buildings and infrastructure during the operational phase.	Medium	Low	MODERATE / LOW RISK There is potential for contaminants within Made Ground / natural strata that could impact the proposed below ground infrastructure. The ground investigation included analysis of a selection of samples, both targeted and to provide general coverage, for potential contaminants which could be corrosive to infrastructure i.e., sulphate and hydrocarbons.
Hazardous gases including methane / carbon dioxide / hydrogen sulphide from landfills, mine workings, infilled colliery / sand / gravel / clay pits etc; Radon; and Naturally occurring organic rich peat deposits.	Inhalation of hazardous ground gases / vapours.	Future site users (within buildings) including maintenance workers / pipeline workers; and Neighbouring site users / members of the public nearby during construction where processes could cause gas migration.	Severe	Low	MODERATE RISK There are several sources of ground gas including former mine workings, landfills, infilled colliery pits etc and there are naturally occurring peat deposits and radon emitting bedrock which could also present a ground gas source. The ground investigation includes the provision of gas wells. The results of the ground gas monitoring have been used to inform recommended mitigation within the REAC. It is noted that radon protection measures are required in Sections 4, 5 and 6 and 7. These should be incorporated within permanent structures proposed for these Sections/BVSSs.

11. ADDITIONAL BASELINE CONSIDERATIONS

A review of the desk-based information was undertaken for the additional baseline considerations. Further detail is included within **Chapter 11 Land and Soils (Volume II)** on the below areas.

11.1. AGRICULTURAL LAND DESIGNATION

- 11.1.1. The Proposed Development Scoping Boundary includes several areas of BMV agricultural land and several ungraded areas that have the potential to include BMV land.
- 11.1.2. There will be temporary sterilisation during the construction phase and potentially very small areas of permanent sterilisation during the operation phase. An agricultural land survey was recommended during the original version of Phase 1 reporting to classify the agricultural land designations. This report has now been produced and is included as **Appendix 11.4 (Volume III)** to Chapter 11 (Land and Soils).

11.2. MINERAL RESOURCE ASSESSMENT

- 11.2.1. The Newbuild Infrastructure Boundary covers several geological strata that are classified as mineral resources. A Mineral Resource Assessment report for the proposed Scoping Boundary was recommended in the original version of the Phase 1 report to assess if sterilisation is likely and assess the feasibility of prior extraction. This report has been produced and is included as Appendix 11.3 to Chapter 11 (Land and Soils).

11.3. COAL MINING RISK ASSESSMENT

- 11.3.1. As sections of the Proposed Development are within Development High Risk Areas, Coal Mining Risk Assessments will be prepared in accordance with the consultation from the Coal Authority (included in Annex G).
- 11.3.2. It was recommended in the original Phase 1 reporting that a Coal Mining Risk Assessment (CMRA) should be produced to assess the ground stability and establish if potential risks from ground instability exist. This report has been produced and is included as **Appendix 11.2 (Volume III)** to Chapter 11 (Land and Soils).

11.4. WASTE DISPOSAL

- 11.4.1. The construction phase of the DCO Proposed Development will generate surplus soil material that may need to be re-used or removed and disposed of at an appropriate landfill.

- 11.4.2. If material is proposed for re-use an appropriate Materials Management Plan should be submitted. In addition, if material is proposed for removal, waste should be handled in accordance with a suitable Waste Management Plans. Both of these documents should be produced in accordance with the CL:AIRE Definition of Waste (Development Industry Code of Practice (version 2) (DoWCoP).
- 11.4.3. All contaminated soil materials should be adequately characterised both chemically and physically (in accordance with BS EN 14899:2005), with the permitting status of any proposed on-site operations made clear. If any waste is to be taken off-site, then it must be subject to management legislation which includes the following:
- Duty of Care Regulations 1991;
 - Hazardous Waste (England and Wales) Regulations 2005;
 - Environmental Permitting (England and Wales) Regulations 2016; and
 - The Waste (England and Wales) Regulations 2011.

12. CONCLUSIONS AND RECOMMENDATIONS

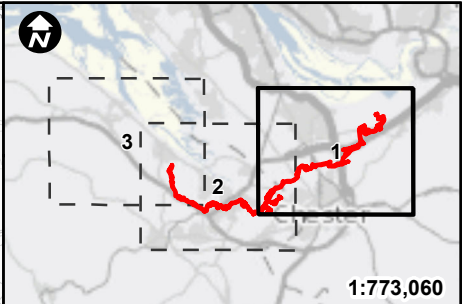
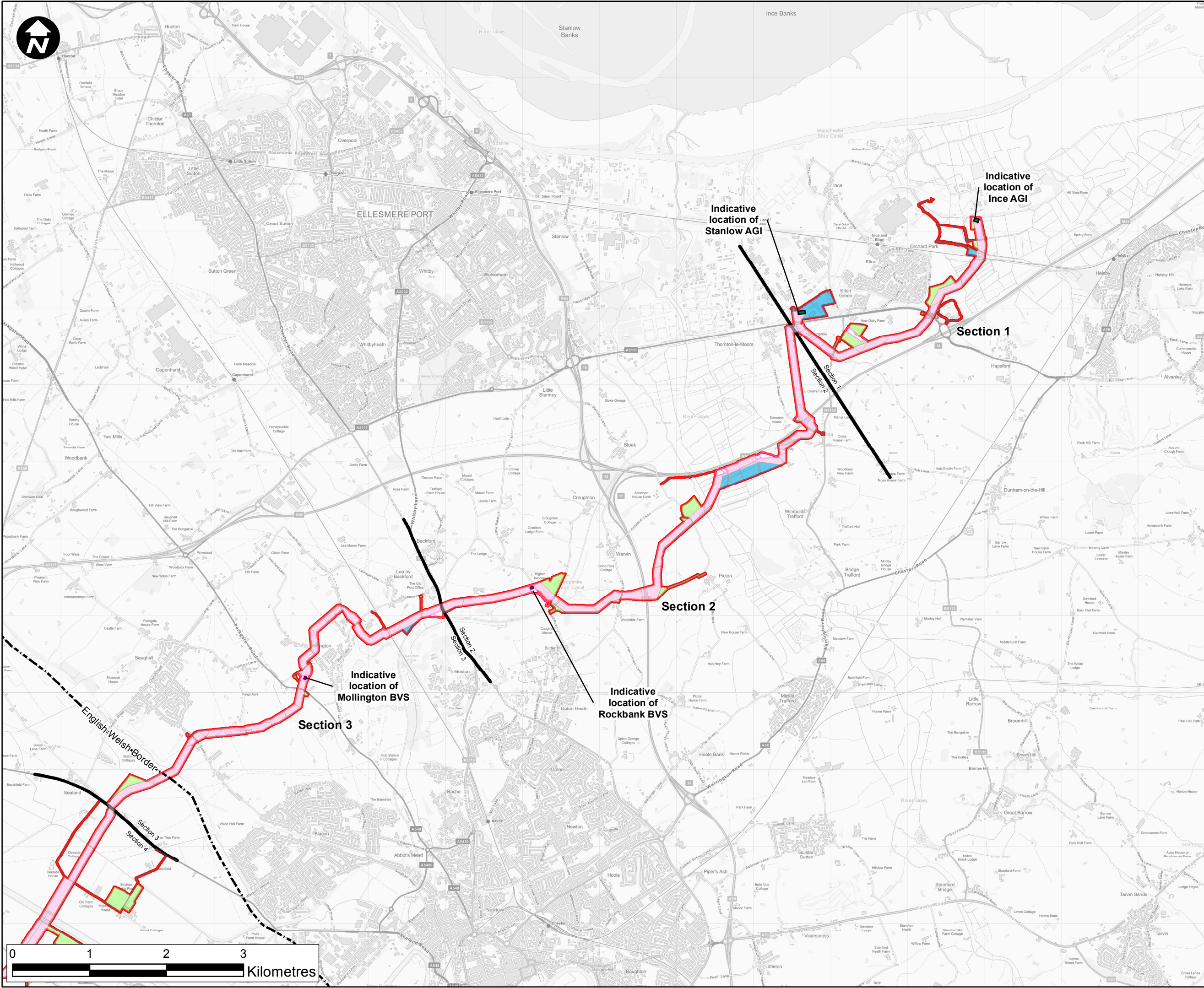
- 12.1.1. A review of the likely ground conditions, environmental setting and potential contaminants has been undertaken for the Newbuild Infrastructure Boundary with a buffer zone of 50m for human health risks and a buffer of 250m for controlled water risks.
- 12.1.2. The ground conditions along the route are considered to predominantly be low risk (predominantly agricultural land) in likelihood of containing significant widespread gross contamination.
- 12.1.3. The original version of this Phase 1 report was provided to consultees during the PINS and the replies established a requirement for additional consideration to the following:
- Intrusive investigation to further refine the identified potentially viable pollutant linkages.
 - An agricultural land classification survey to provide contemporary grading classifications to inform the restoration of the land following the installation of the pipeline.
 - A mineral resource assessment to understanding if mineral resources would be sterilised within the Newbuild Infrastructure Boundary.
 - A coal mining risk assessment to inform if there are potential ground stability issues which could then be used to refine the Proposed Newbuild Pipeline Route.
- 12.1.4. Further details on the points listed above are presented within **Chapter 11 Land and Soils (Volume II)** and its other associated Appendices.

13. REFERENCES

- **Ref 13.1** - British Geological Survey GeoIndex Onshore Map viewer, accessed in May 2022 via [REDACTED]
- **Ref 13.2** - Coal Authority Interactive Map viewer accessed in May 2022 via [REDACTED]
- **Ref. 13.3** - Department for Environment Food & Rural Affairs (DEFRA); Environment Agency Catchment Data Explorer, accessed in May 2022 via <https://environment.data.gov.uk/catchment-planning>.
- **Ref. 13.4** - Department for Environment Food & Rural Affairs (DEFRA) Magic Map website, accessed in May 2022 via <https://magic.defra.gov.uk/MagicMap.aspx>.
- **Ref. 13.5** - Natural Resource Wales Data Map, accessed in May 2022 via https://datamap.gov.wales/maps/new?layer=inspire-wg:wg_predictive_alc2.
- **Ref. 13.6** - DMRB LA 109 Geology and Soils, dated October 2019, accessed in May 2022 via [REDACTED]
- **Ref. 13.7** - Cranfield Soil and Agri-food Institute Soilscales Viewer, accessed in MAY 2022 via LandIS - Land Information System - current pagename
- **Ref. 13.8** - Flintshire County Council (FCC) Contaminated Land Register, accessed in May 2022 via <https://www.flintshire.gov.uk/en/Resident/Land-and-Property/Contaminated-land.aspx>
- **Ref. 13.9** - Public Health England Radon Website, accessed in May [REDACTED]

Annex A

FIGURES



- Key:**
- Newbuild Infrastructure Boundary
 - Above Ground Installation (AGI)
 - Block Valve Station (BVS)
 - Permanent acquisition of land
 - Permanent acquisition of subsurface
 - Permanent acquisition of rights
 - Temporary possession of land
 - Temporary use of rights
 - Section Dividing Line

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PROJECT TITLE
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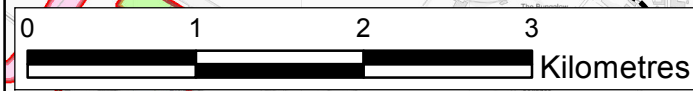
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Section 1-3
Sheet 1 of 3

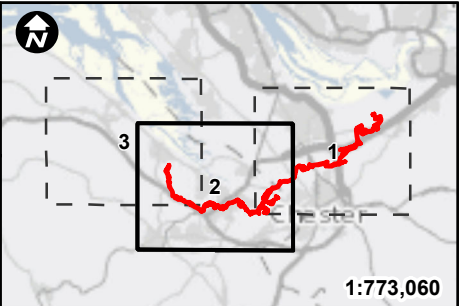
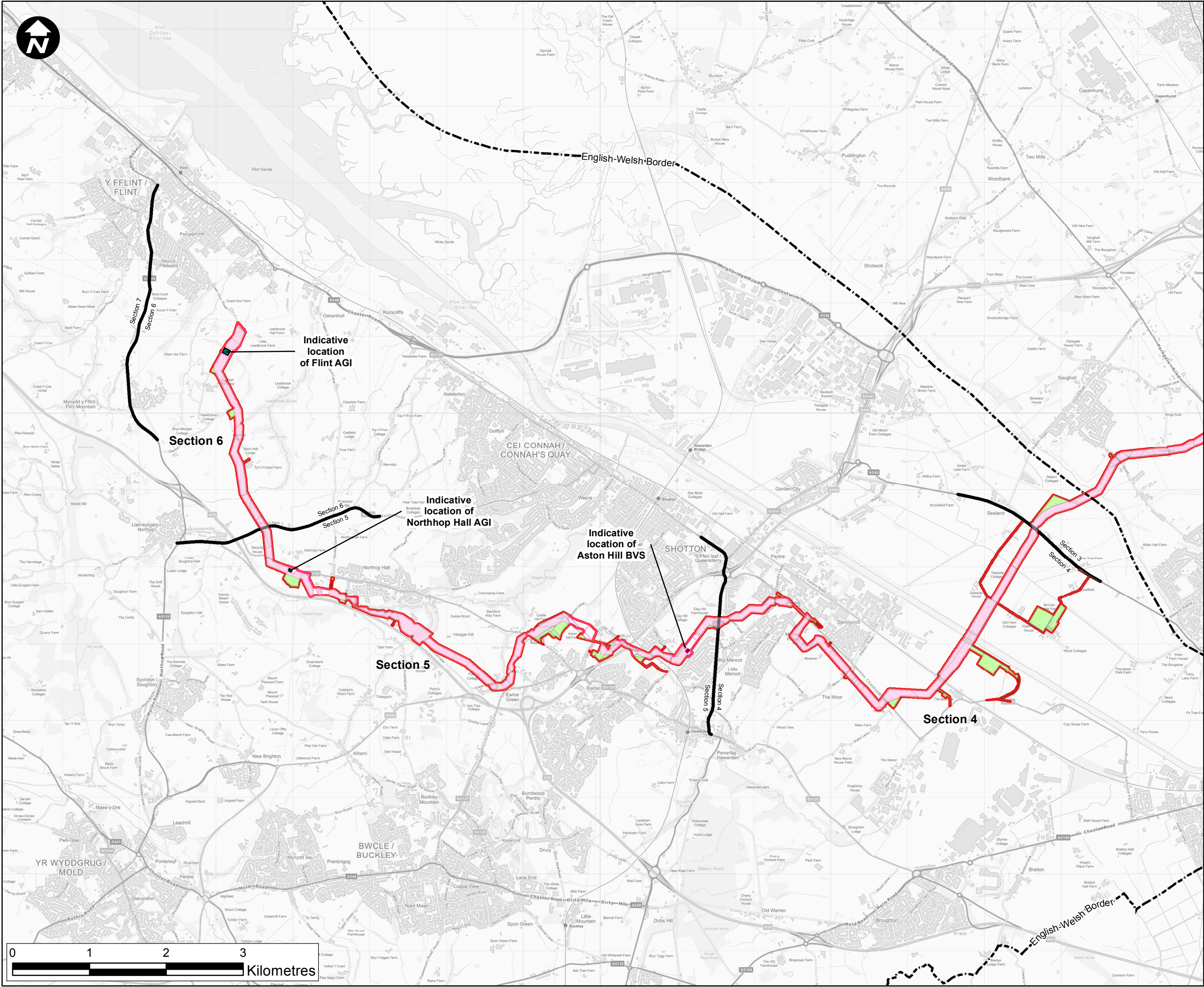
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- Key:**
- Newbuild Infrastructure Boundary
 - Above Ground Installation (AGI)
 - Block Valve Station (BVS)
 - Permanent acquisition of land
 - Permanent acquisition of subsurface
 - Permanent acquisition of rights
 - Temporary possession of land
 - Temporary use of rights
 - Section Dividing Line

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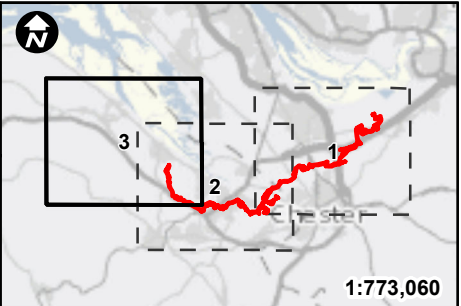
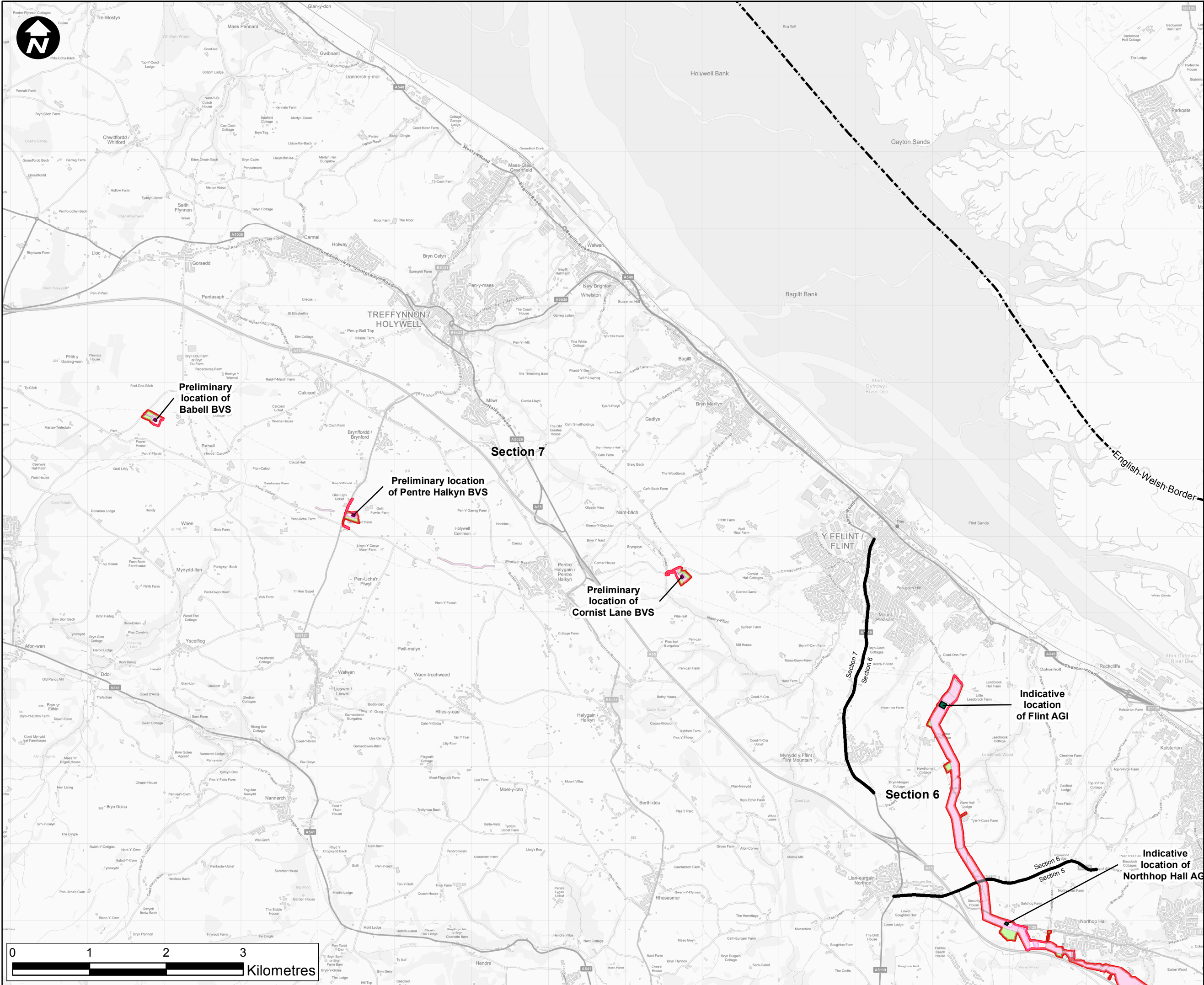
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- Key:**
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 - Above Ground Installation (AGI)
 - Block Valve Station (BVS)
 - Permanent acquisition of land
 - Permanent acquisition of subsurface
 - Permanent acquisition of rights
 - Temporary possession of land
 - Temporary use of rights
 - Section Dividing Line

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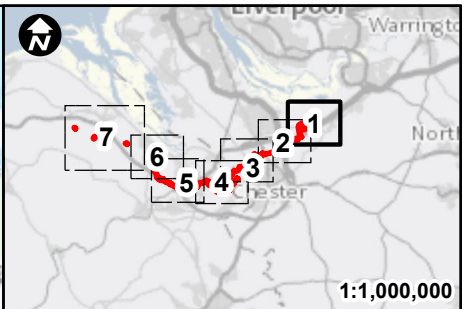
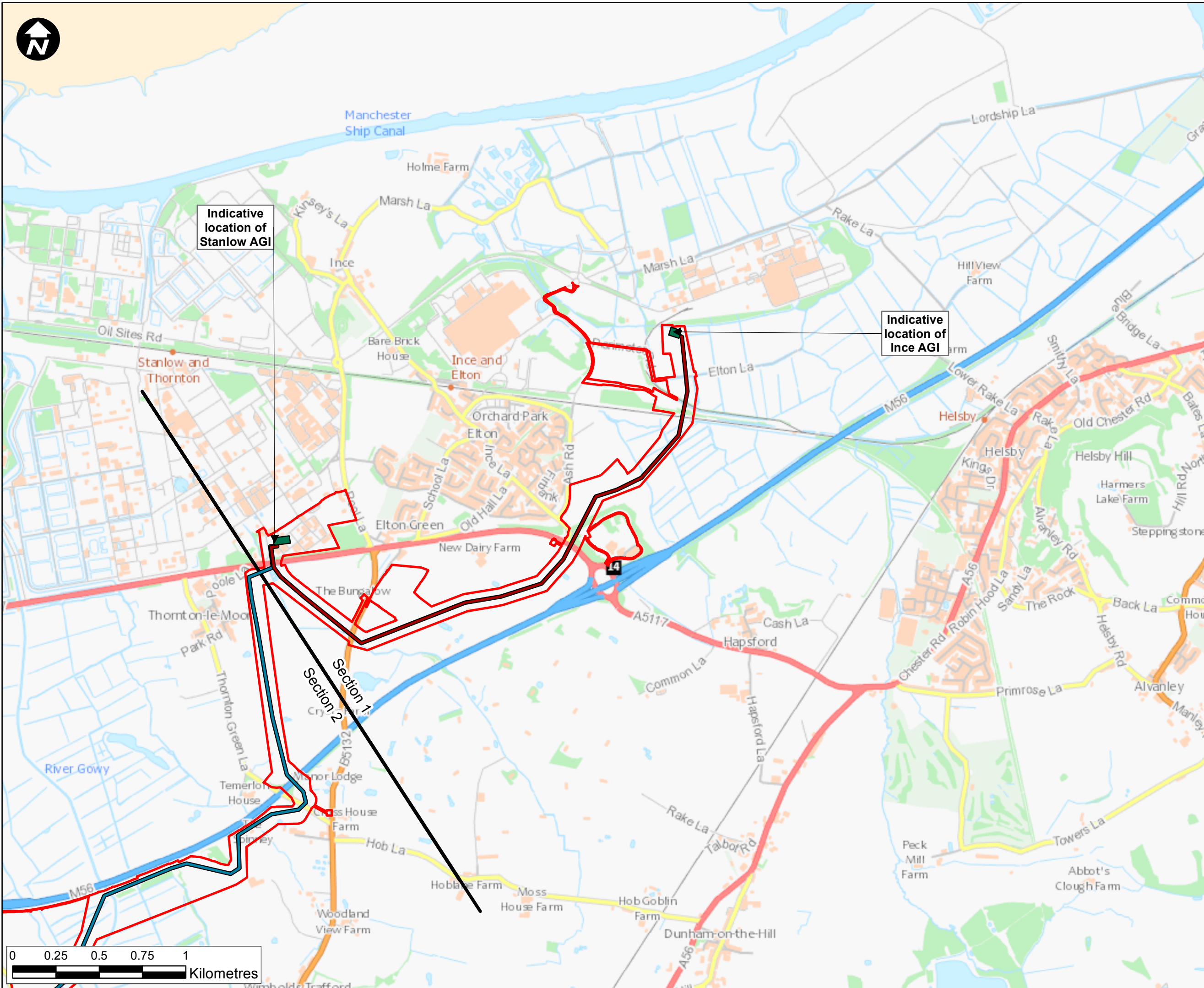
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Section 7
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- Key:**
- Section Dividing Line
 - Newbuild Infrastructure Boundary
 - Above Ground Installation (AGI) – Representative extent
 - Ince AGI to Stanlow AGI
 - Stanlow AGI to Flint AGI

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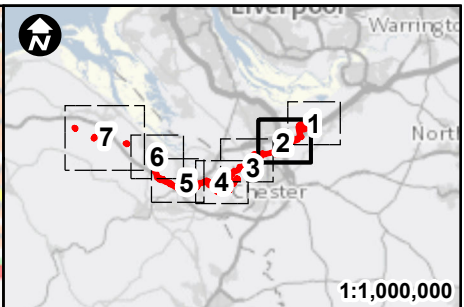
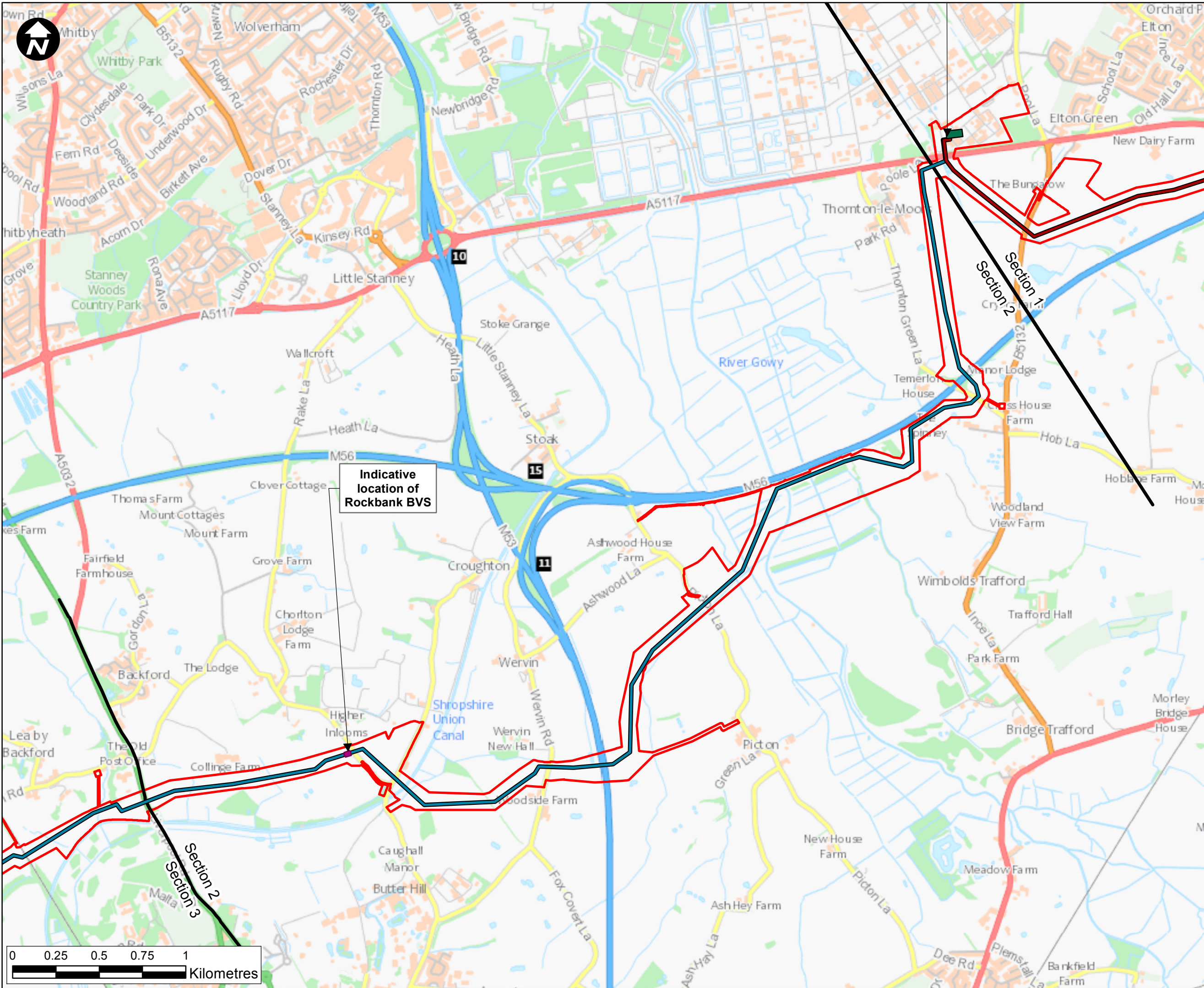
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- Key:**
- Section Dividing Line
 - Newbuild Infrastructure Boundary
 - Above Ground Installation (AGI) – Representative extent
 - Block Valve Station (BVS) – Representative extent
 - Ince AGI to Stanlow AGI
 - Stanlow AGI to Flint AGI

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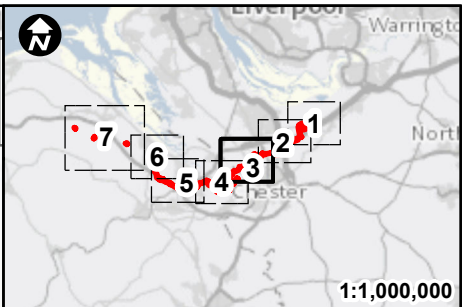
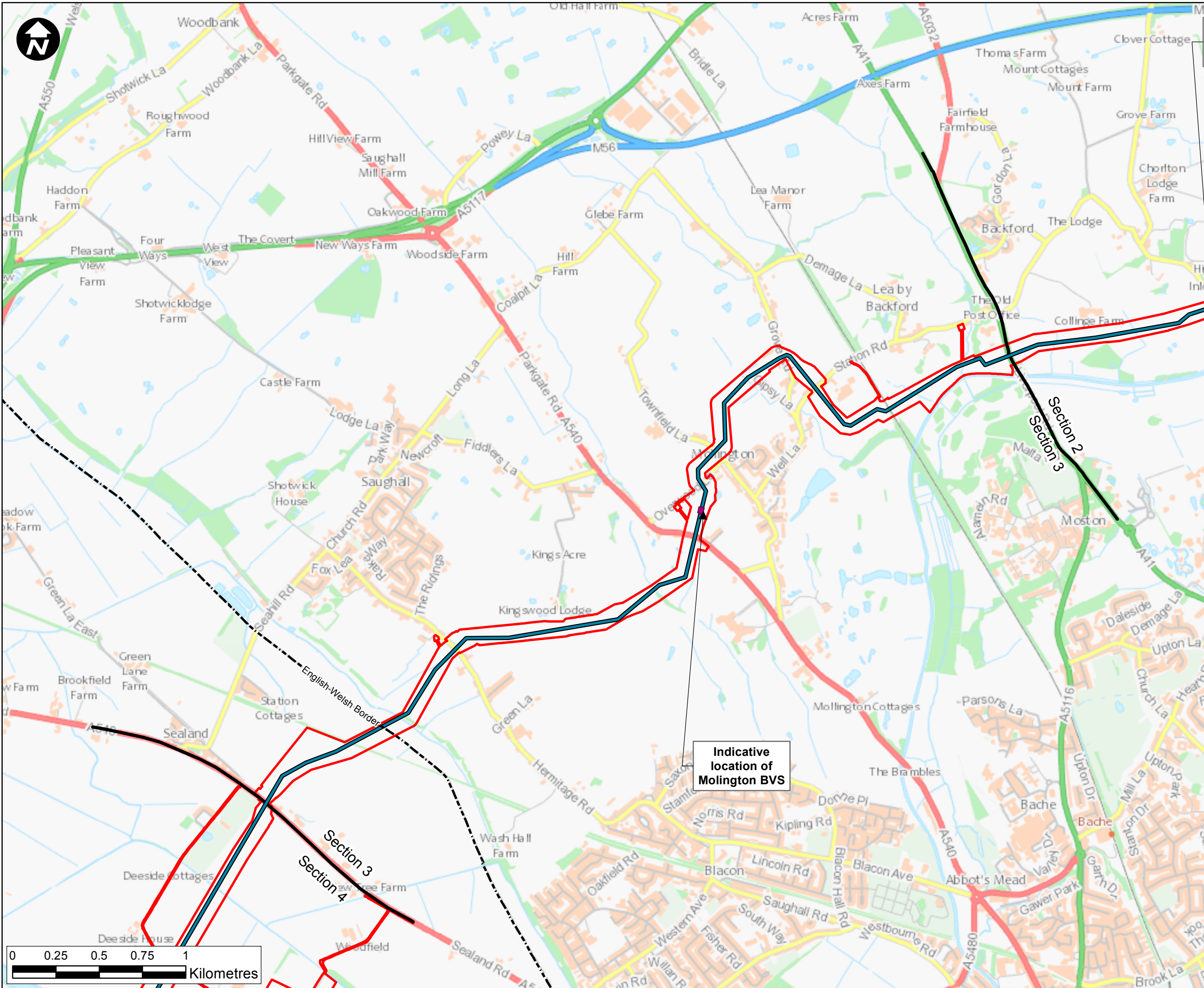
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- Key:**
- Section Dividing Line
 - Newbuild Infrastructure Boundary
 - Block Valve Station (BVS) – Representative extent
 - Stanlow AGI to Flint AGI

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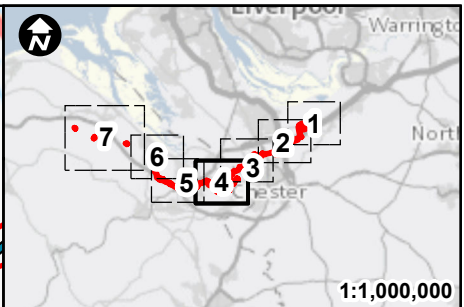
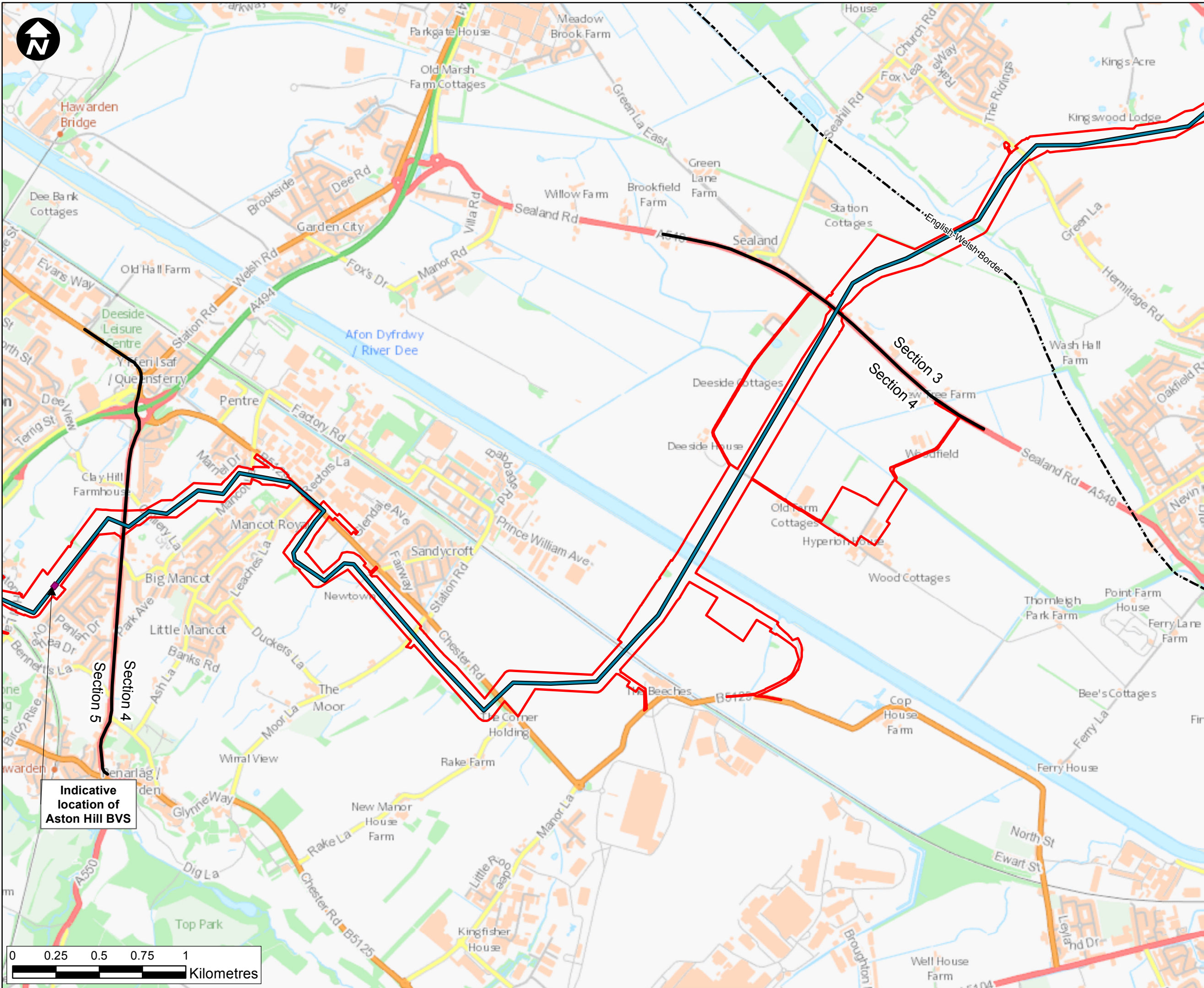
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Key:

- Section Dividing Line
- Newbuild Infrastructure Boundary
- Block Valve Station (BVS) – Representative extent
- Stanlow AGI to Flint AGI

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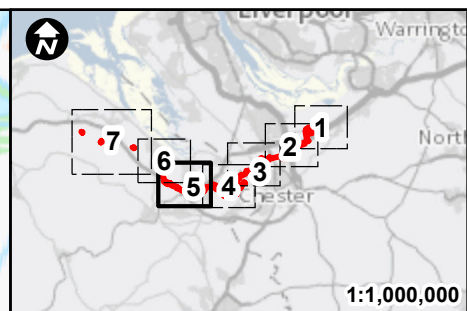
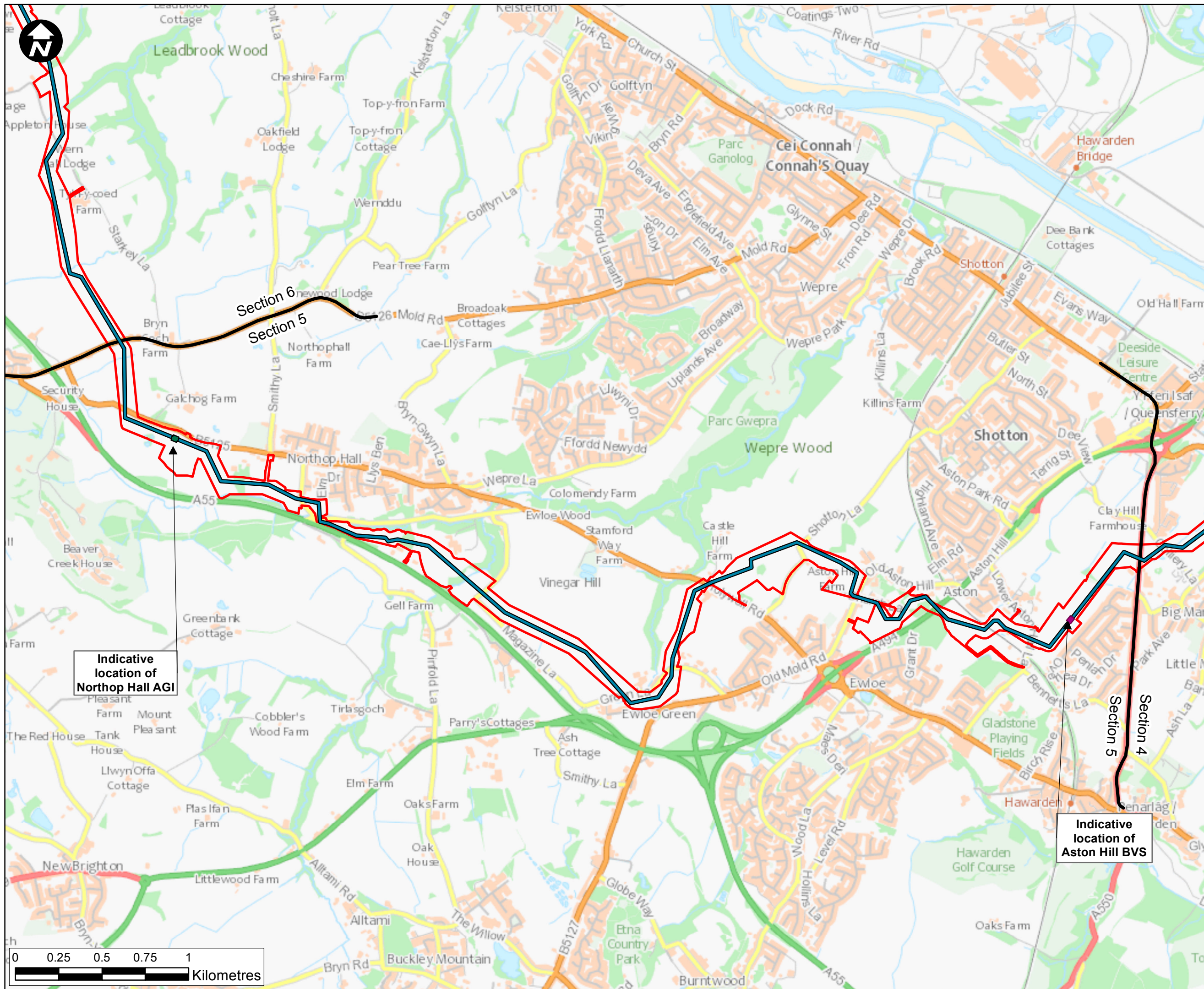
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- Key:**
- Section Dividing Line
 - Newbuild Infrastructure Boundary
 - Above Ground Installation (AGI) – Representative extent
 - Block Valve Station (BVS) – Representative extent
 - Stanlow AGI to Flint AGI

Indicative location of Northop Hall AGI

Indicative location of Aston Hill BVS

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PROJECT TITLE
HyNet Carbon Dioxide Pipeline DCO

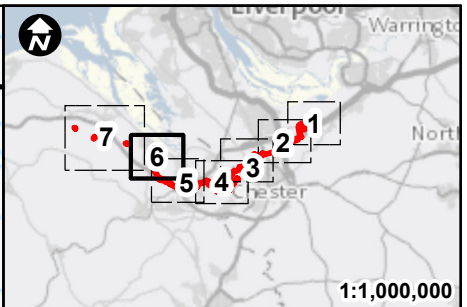
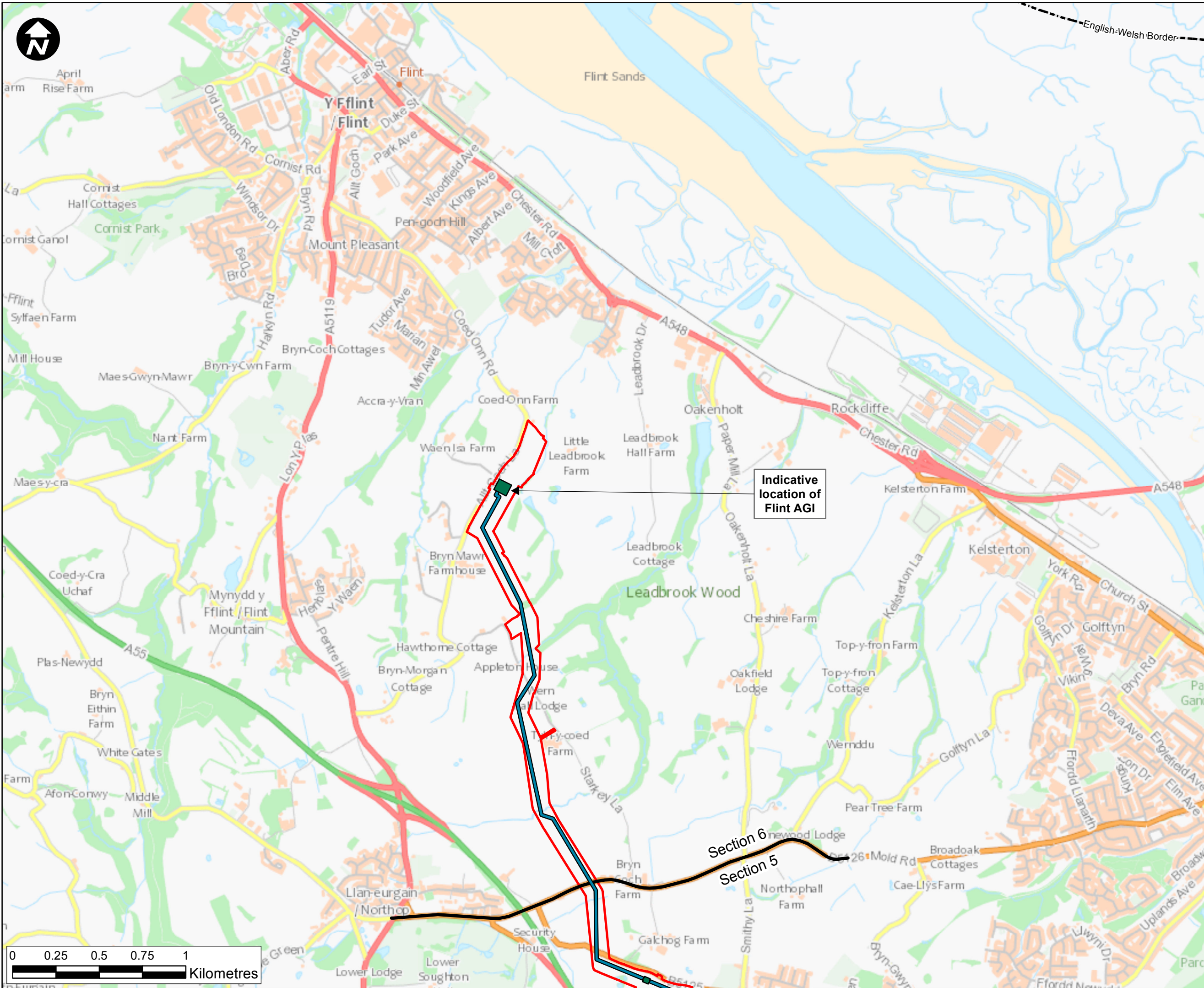
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TH	NC	DF	DP

SCALE @ A3 SIZE	DATE	REVISION
1:20,000	26/08/2022	P01

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EN070007-APP-ES-11.1.2-Sheet 5



- Key:**
- Section Dividing Line
 - Newbuild Infrastructure Boundary
 - Above Ground Installation (AGI) – Representative extent
 - Stanlow AGI to Flint AGI

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HyNet North West

PROJECT TITLE
HyNet Carbon Dioxide Pipeline DCO

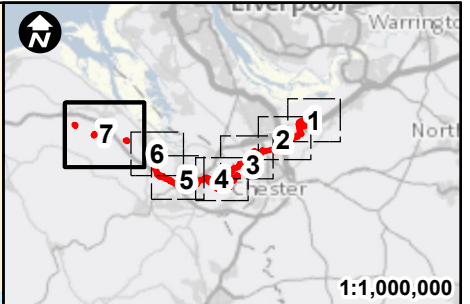
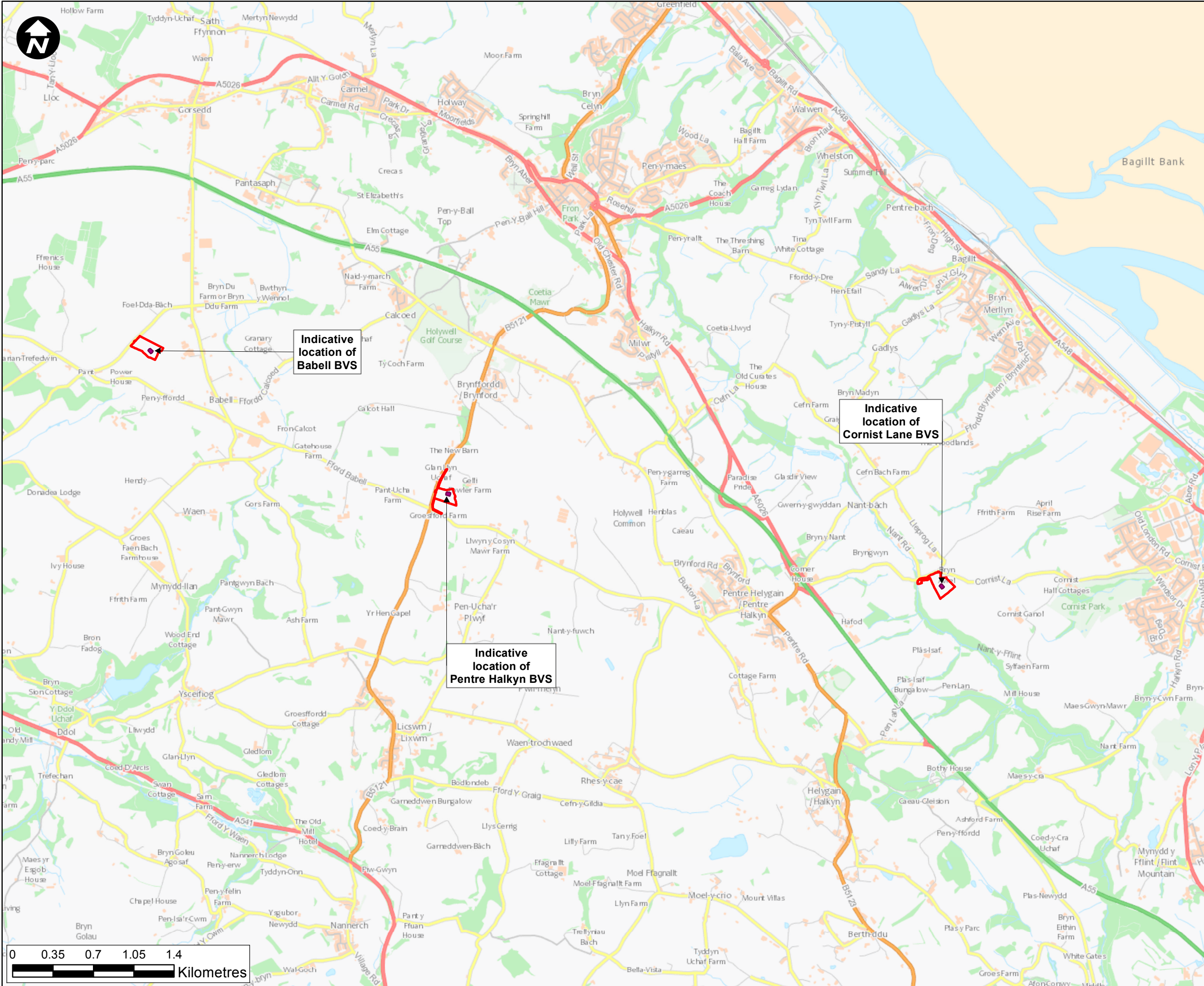
DRAWING TITLE
Figure 11.1.2: Site Layout Plan Sheet 6

DRAWING STATUS
FOR INFORMATION

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TH	NC	DF	DP

SCALE @ A3 SIZE	DATE	REVISION
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DRAWING NUMBER
EN070007-APP-ES-11.1.2-Sheet 6



Key:

- Newbuild Infrastructure Boundary
- Block Valve Station (BVS) – Representative extent

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HyNet North West

PROJECT TITLE
HyNet Carbon Dioxide Pipeline DCO

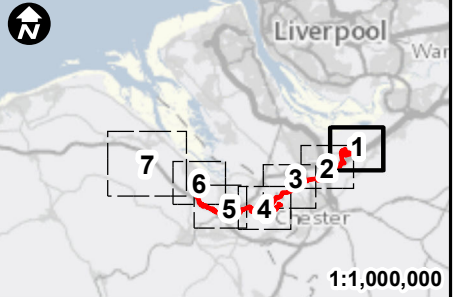
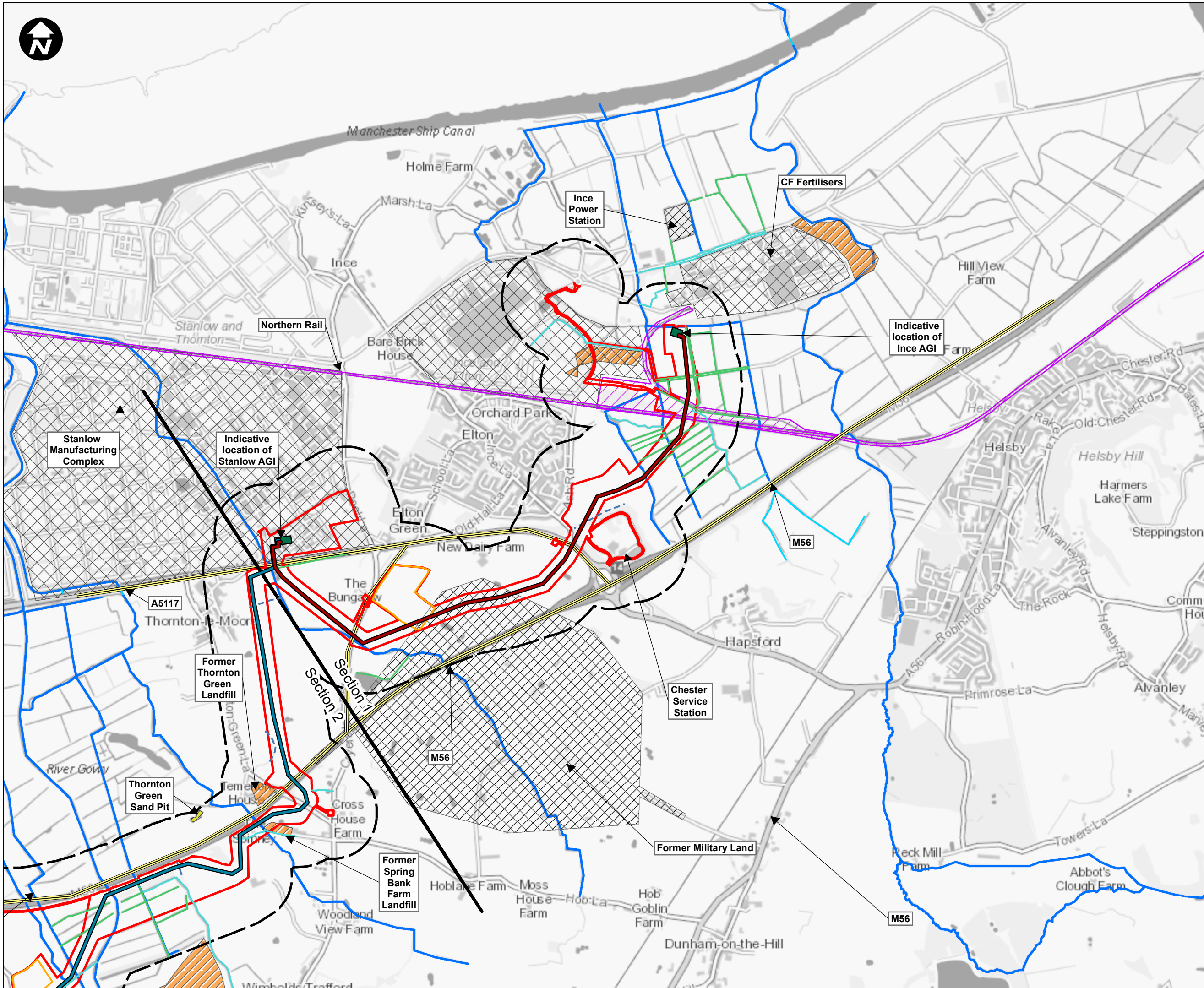
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Figure 11.1.2: Site Layout Plan Sheet 7

DRAWING STATUS
FOR INFORMATION

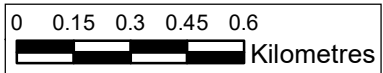
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TH	NC	DF	DP

SCALE @ A3 SIZE	DATE	REVISION
1:30,000	26/08/2022	P01

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EN070007-APP-ES-11.1.2-Sheet 7



- Key:**
- Newbuild Infrastructure Boundary
 - Ince AGI to Stanlow AGI
 - Stanlow AGI to Flint AGI
 - Above Ground Installation (AGI)
 - 250m Buffer
 - Main roads / Motorways
 - Railway Land
 - Industrial Land
 - Landfills
 - Temporary construction compounds
 - River/Stream/Beck or other waterway
 - Section Dividing Line
 - Ditch
 - Ordinary Watercourse
 - Ordinary Watercourses - Others
 - Unknown



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**HyNet North West
Carbon Dioxide Pipeline DCO**

**Figure 11.1.3: Potential Contaminant
Sources - Section 1
Sheet 1 of 7**

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FOR INFORMATION

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SCALE @ A3 SIZE	DATE	REVISION
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EN070007-APP-ES-11.1.3-Sheet 1