

Viking CCS Pipeline

6.12 Viking CCS Bridging Document

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1 Introduction

1.1 Viking CCS Project

General Background

1.1.1 Chrysaor Production (U.K.) Limited, a Harbour Energy group company, intends to transport compressed and conditioned Carbon Dioxide (CO₂) from the delivery point at Immingham to storage in depleted gas reservoirs in the Southern North Sea. This overall project is called the Viking Carbon Capture Storage Project (Viking CCS Project) as shown in **Figure 1-2**.

1.1.2 The Viking CCS Project consists of the following two main components:

- **The Viking CCS Pipeline:** an onshore transportation system comprising a buried approximately 55.5 kilometre (km) 24 inch (") diameter onshore pipeline commencing at the Immingham Facility, connecting to the Theddlethorpe Facility, which would include a pipeline crossover to the existing Lincolnshire Offshore Gas Gathering System (LOGGS) offshore pipeline to Mean Low Water Springs (MLWS) tide mark; and
- **The Viking CCS Offshore Development Project:** An offshore system repurposing the existing decommissioned 36" diameter LOGGS pipeline, a new 23 km offshore extension of 36" diameter pipeline and a new Not Permanently Attended Installation (NPAI) with facilities to inject the conveyed CO₂ into the depleted gas reservoirs under the Southern North Sea.

1.1.3 Repurposing the existing offshore gas transmission pipeline infrastructure supports the wider project objective to minimise the environmental impact of delivering the Viking CCS Project.

1.1.4 Throughout this document, the Viking CCS Pipeline will be referred to as 'the Proposed Development' and the Viking CCS Offshore Development Project as 'the Offshore Project'.

What is Carbon Capture and Storage?

1.1.5 Carbon capture and storage (CCS) is a three-step process for reducing emissions of carbon dioxide to the atmosphere by:

- Capturing carbon dioxide (CO₂) emissions from industrial processes, such as refining and power generation, or from the burning of fossil fuels in power generation;
- Transporting it from where it was produced, for example via a pipeline; and
- Storing it deep underground in geological formations.

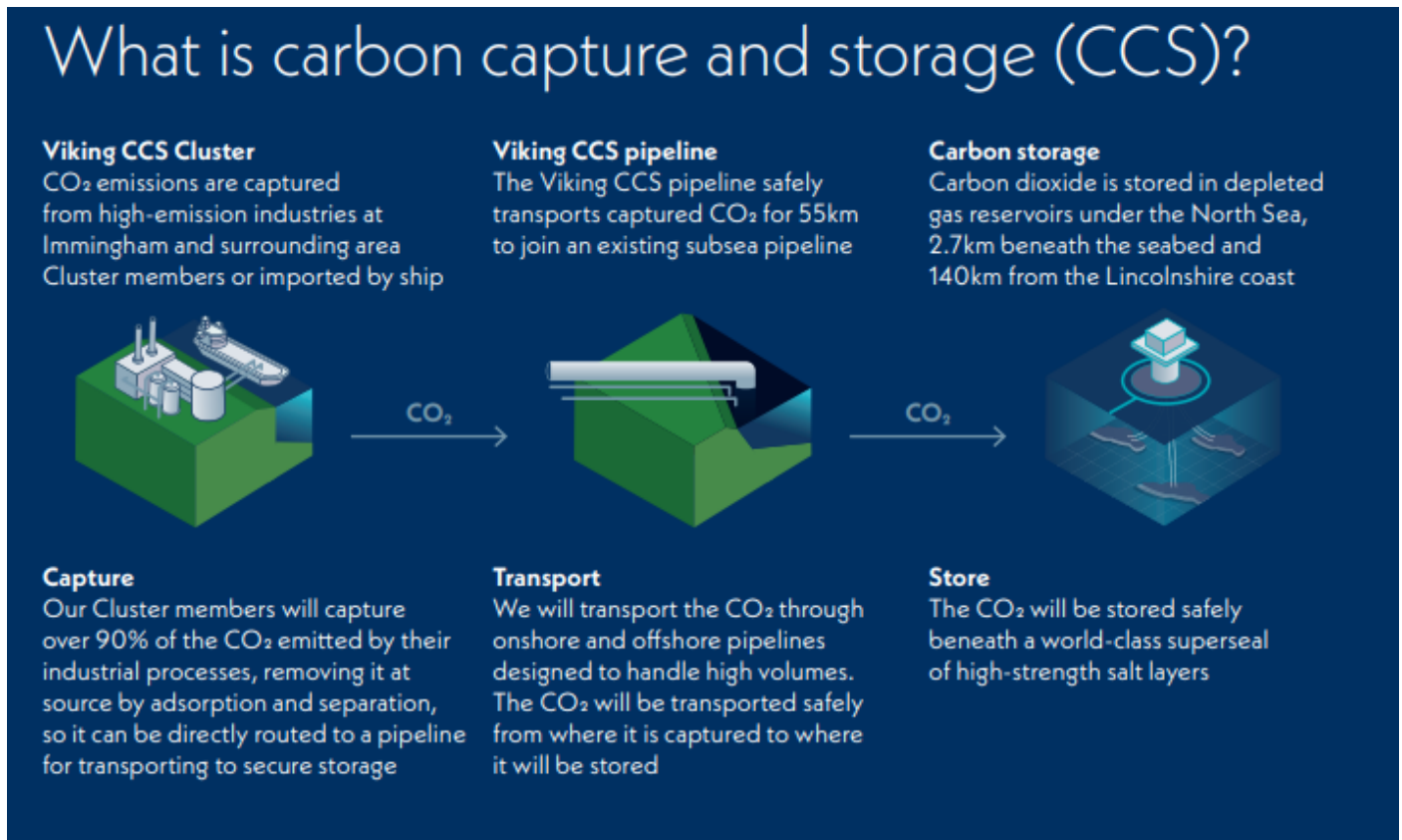
1.1.6 Possible storage sites for carbon emissions include saline aquifers or depleted oil and gas reservoirs, which typically need to be 0.62 miles (1km) or more below the ground.

1.1.7 **Figure 1-1** illustrates the three-step process described above.

The Applicant

1.1.8 The Viking CCS Project is being developed by Chrysaor Production (U.K.) Limited (hereafter "the Applicant"), which is a subsidiary of Harbour Energy plc. Harbour Energy plc was formed in 2021 through a merger between Chrysaor Holdings Limited and Premier Oil plc, and is the largest UK listed independent oil and gas company with its legacy companies having almost 90 years operating experience.

Figure 1-1: Carbon Capture and Storage Explained



- 1.1.9 The Applicant is committed to helping solve the dual challenge the world energy markets face, namely increasing energy supply to meet growing demand and doing so with lower greenhouse-gas emissions. They are committed to playing their role in the transition to a lower-carbon economy whilst minimising the environmental impact of their operations around the world. Their overall strategy also includes leveraging their existing skills and infrastructure to pursue CO₂ transport and storage.
- 1.1.10 In support of this, the Applicant has committed to achieving Net Zero for their Scope 1 and 2 greenhouse gas emissions by 2035. For this to be achieved, the Applicant will need to make reductions in their own emissions supplemented by the purchase of independently verified offsets to mitigate the impact of the remaining emissions.
- 1.1.11 The Crown Estate is responsible for granting leases for offshore pipeline transportation, seabed and subsurface rights to developers for carbon dioxide storage, with the regulation of projects being carried out by the licensing authority, the North Sea Transition Authority (NSTA). NSTA regulates offshore carbon dioxide storage and is the licensing authority. NSTA approve and issue storage permits – and maintains the carbon storage public register. Chrysaor Production (U.K.) Limited (a subsidiary of Harbour Energy, the Applicant) was awarded the Applicant a CO₂ appraisal and storage licence in 2021 (CS005 licence). The Viking CCS Project aims to transport and store up to 10 million tonnes of CO₂ annually by 2030, rising to 15 million tonnes by 2035.
- 1.1.12 The Applicant has a long history of operating in the Humber and Lincolnshire area, providing safe and environmentally sound operations. In particular, they have more than 40 years of operational experience relating to the Viking field area, helping to support their geological understanding of the field and the regionally extensive reservoirs that are capable of securely storing the CO₂. Additionally, they also operated the Theddlethorpe Gas Terminal (TGT) site over the same time period.

Figure 1-2: Overall Viking Carbon Capture Storage Project (including the Viking CCS Pipeline)



1.2 Purpose of this Document

- 1.2.1 This document is referred to as a “Bridging Document” and it is intended to provide an overall summary of the onshore and offshore elements of the project, including providing an overview of the combined environmental effects of the Viking CCS Project.
- 1.2.2 The Bridging Document will enable those with an interest in the Viking CCS Project to understand how the Project will affect them and provides an overview of the main interfaces of the environmental assessments and the likely in-combination effects of the onshore and offshore elements of the Project.
- 1.2.3 The intention of the Bridging Document is not to convey all of the information relating to the Project and its potential effects on the environment. This document provides a summary of the findings of the detailed environmental assessment which accompanies the consenting application for the Proposed Development, and information relating to the scoping of the environmental impact assessment for the Offshore Project.
- 1.2.4 The summary of the environmental assessment for the Proposed Development and the Offshore Project are presented below. It should be noted that the presentation of results differs as they follow the format required by consenting authorities, and also reflect the stage of development each individual project has attained, at the time this document was prepared (August 2023).
- 1.2.5 More detailed information on the Viking CCS Project is contained within the Project website: <https://www.harbourenergy.com/safety-esg/viking-ccs/>

1.3 Project Need

- 1.3.1 The UK government has committed to a legally binding target of achieving Net Zero by 2050. To meet this target, the UK needs to transition towards cleaner sources of energy, while decarbonising existing infrastructure. That is where carbon capture technology is set to play a crucial role.
- 1.3.2 Carbon capture and storage is recognised by the Intergovernmental Panel on Climate Change and the UK Government as a vital step on the road to achieving Net Zero carbon emissions.
- 1.3.3 The Proposed Development is located in the Humber, the UK’s most industrial and carbon dioxide emissions-intensive region and is uniquely placed to help the UK decarbonise and grow, by providing a gateway for investment and the development of a regional low-carbon hub.
- 1.3.4 Over 70% of the total carbon dioxide emissions from the Humber industrial area are located on the Lincolnshire side of the River Humber, where the Proposed Development is located. Decarbonising these industries is needed not only to meet the UK’s Net Zero goals, but also to preserve industry and the associated skilled jobs in the region.
- 1.3.5 With the Humber area releasing around 20 million tonnes of carbon dioxide per year, the Viking CCS Project can fulfil more than 50 % of the CCS requirement for the area, whilst also offering a route to deliver one third of the UK’s target of 30 million tonnes of CO₂ capture by 2030, enabling the large-scale decarbonisation of industrial and energy emissions.
- 1.3.6 The Viking CCS Project is viewed as being vital in helping to meet the UK government’s net zero targets, energy security and industrial rejuvenation, and there is a clear need for the development.

2 Environmental Assessment

2.1 Overview

Viking CCS Pipeline (Onshore)

2.1.1 The key components of the Viking CCS Pipeline comprise the following:

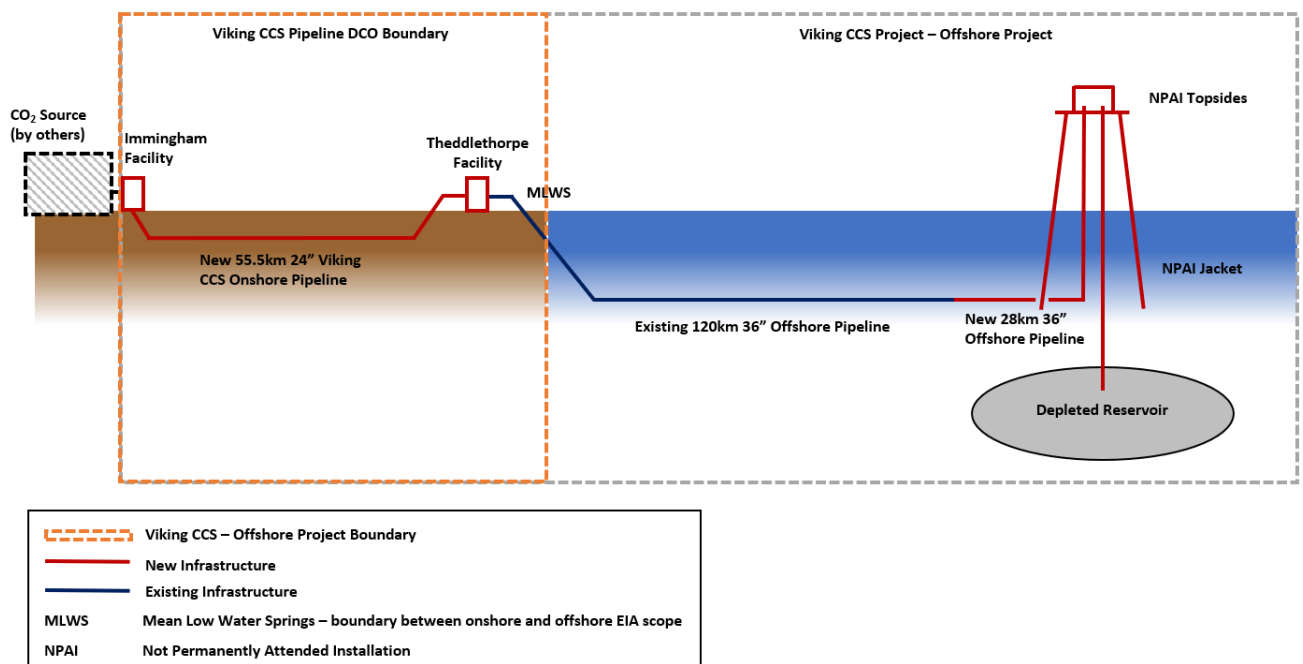
- Immingham Facility;
- Approximately 55.5 km buried 24 inch (") onshore steel pipeline (including cathodic protection);
- Three Block Valve Stations;
- Theddlethorpe Facility – two current options;
- Existing LOGGS Pipeline to the extent of the DCO limits at MWLS and shutdown and isolation valves; and
- Dune Isolation Valve.

Viking CCS Development Project (Offshore)

2.1.2 The proposed Viking CCS development will include the following activities:

- Repurpose existing 118 km 36" offshore LOGGS pipeline;
- Installation of new 28 km 36" offshore pipeline spur;
- Installation of new offshore not permanently attended installation (NPAI) at the Victor Field;
- Drilling of CO₂ injector wells;
- Operation and maintenance of pipelines, subsea isolation valve (SSIV), wells and NPAI; and
- Continued monitoring and management of the storage reservoir.

Figure 2-1: Schematic of Viking CCS Project



2.2 Onshore consenting regime

Requirement for a DCO

2.2.1 Onshore pipelines over 16.093 km (10 miles) in length are classified as Nationally Significant Infrastructure Projects (NSIPs) under section 14(1)(g) of the Planning Act 2008 (as amended) (**Ref 1**) and require development consent to be granted under Section 31 of the Planning Act 2008 for their development. In accordance with the Planning Act 2008, a DCO is required to allow the construction, operation and maintenance of the Proposed Development.

2.2.2 The Planning Inspectorate has published 18 advice notes to inform applicants, consultees, the public and others about a range of matters in relation to applications under the Planning Act 2008 (**Ref 1**).

2.2.3 An application for a DCO will be submitted to Secretary of State (SoS) for Department of Energy Security and Net Zero (DESNZ) via the Planning Inspectorate. The DCO application will be accompanied by an Environmental Statement (ES), prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations) (**Ref 2**).

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the APFP Regulations) (**Ref 3**) set out the documentation required to accompany a DCO application and stipulate at regulation 5(2)(a) that an ES is to be provided where a project is an EIA development.

2.2.4 The development covered by the DCO comprises:

- A pipeline for the conveyance of CO₂, and apparatus and works associated therewith, including inlet facilities, offshore pipeline tie-in and outlet facilities;
- Block Valve Stations;
- Ancillary works integral to the construction of the pipeline, including; construction compounds, temporary access tracks, and laydown areas;
- Land required for the construction, operation and maintenance of the pipeline; and
- The use of the existing offshore pipeline down to MLWS.

2.2.5 The Department for Energy and Climate Change (now Department for Energy Security and Net Zero (DESNZ)) published several National Policy Statements (NPS) in relation to nationally significant energy infrastructure, which were designated by the SoS for Energy and Climate Change in July 2011.

2.2.6 There are no existing energy NPSs directly applicable to CO₂ transportation projects such as the Proposed Development, but the following NPSs may still be important and relevant considerations in assessing it:

- Overarching National Policy Statement for Energy (EN-1) (**Ref 4**); and
- National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (**Ref 5**).

2.2.7 NPS EN-4 applies to nationally significant infrastructure pipeline projects which transport natural gas or oil. However, NPS EN-4 notes that the information provided within may also be useful in identifying impacts to be considered in applications for pipelines intended to transport other substances.

- 2.2.8 Updated drafts of both EN-1 (**Ref 6**) and EN-4 (**Ref 7**) were issued in 2021 and re-emphasised the government's plans to help decarbonise the UK's economy. These new emerging documents and any subsequent formal adoption of new NSPs for energy infrastructure will be considered where relevant during the production of the ES.
- 2.2.9 Section 105 of the Planning Act 2008 confirms that where no NPS has effect, projects should be tested against 'important and relevant' matters, which are the relevant NPS, local adopted planning policies and the National Planning Policy Framework (NPPF) (**Ref 8**).
- 2.2.10 The Localism Act 2011 (**Ref 9**) provided the Secretary of State with the authority and responsibility for processing DCO applications for NSIPs, with the power to appoint the Inspectorate. In its role, the Inspectorate will appoint an Examining Authority to examine the DCO application for the Scheme who will then make a recommendation to the Secretary of State. The Secretary of State will then decide whether to grant a DCO.

Requirement for an EIA

- 2.2.11 Under the EIA Regulations (**Ref 2**), where an application is made for a DCO for "EIA development" then an EIA must be carried out and an ES submitted with the application. Under regulation 3 of the EIA Regulations, "EIA development" means any development which is either (a) listed within schedule 1 of the regulations, or (b) listed within schedule 2 of the regulations and where the development likely to have significant effects on the environment by virtue of factors such as its nature, size or location.
- 2.2.12 The Proposed Development does not fall within the list of development in schedule 1 of the EIA Regulations (**Ref 2**). However, it falls within paragraph 3(j) of Schedule 2: "*installations for the capture of CO₂ streams for the purposes of geological storage pursuant to Directive 2009/31/EC from installations not included in Schedule 1 to these Regulations.*" It is considered that the Proposed Development is likely to have significant effects on the environment and is therefore an EIA development for which an EIA must be undertaken.
- 2.2.13 In accordance with Regulation 8(1)(b) of the EIA Regulations, the Applicant has notified the Secretary of State in a letter to the Inspectorate dated 14 November 2022 that an ES presenting the findings of the EIA will be submitted with the DCO application.
- 2.2.14 The topics that the Applicant considers the EIA needs to address were identified in the EIA Scoping Report which was submitted to the Inspectorate on 29 March 2022. This is included as *ES Volume IV Appendix 5.1 (Application Document 6.4.5.1)*.
- 2.2.15 On behalf of the Secretary of State, the Inspectorate reviewed and consulted on the EIA Scoping Report and published an EIA Scoping Opinion on 5 May 2022 which included the formal responses received by the Inspectorate from consultees.
- 2.2.16 The formal responses received by the Inspectorate from consultees have been considered within the environmental assessments within the ES and addressed where appropriate. *ES Volume IV Appendix 5.3 Project Responses to Scoping Opinion (Application Document 6.4.5.3)* of the ES includes tabulated responses to comments provided in the EIA Scoping Opinion. Where appropriate, key issues raised in the EIA Scoping Opinion are also summarised and responded to in each technical chapter (Chapters 6-20) of *ES Volume II (Application Document 6.2)*.

2.3 Offshore consenting regime

Requirement for a Lease

- 2.3.1 The Crown Estate is responsible for granting leases for offshore pipeline transportation, seabed and subsurface rights to developers for CO₂ storage, with the regulation of projects being carried out by the licensing authority, the North Sea Transition Authority (NSTA).

2.3.2 The NSTA regulates offshore CO₂ storage, approves and issues storage permits, and maintains a Carbon and Capture Storage (CCS) public register. Carrying out regulated CCS operations without a license is prohibited.

Requirement for an EIA

2.3.3 The offshore elements of the Viking CCS Project are governed by The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020, which requires the undertaking of an EIA and the production of an ES for offshore developments, including activities related to the storage of CO₂. Following acceptance of the ES, consent may be granted by the Secretary of State via the licencing authority.

2.3.4 The Marine and Coastal Access Act 2009 introduced a marine planning system, comprising the UK Marine Policy Statement and regional marine plans, with compliance with the relevant marine plan necessary for any licences to be granted.

2.3.5 For the offshore elements of the Viking CCS Project, the relevant Marine Plan is the East Marine Plan, which encompasses the East Inshore Marine Plan and the East Offshore Marine Plan (DEFRA, 2014). The aim of the marine plan is to help ensure the sustainable development of the marine area. Within the East Marine Plan, two specific CCS policies have been set out, one of which (CCS2) ensures that CCS proposals should consider the re-use of existing infrastructure rather than the installation of new infrastructure. The ES will aim to demonstrate how the Viking CCS Project will align with the relevant Marine Plan policies.

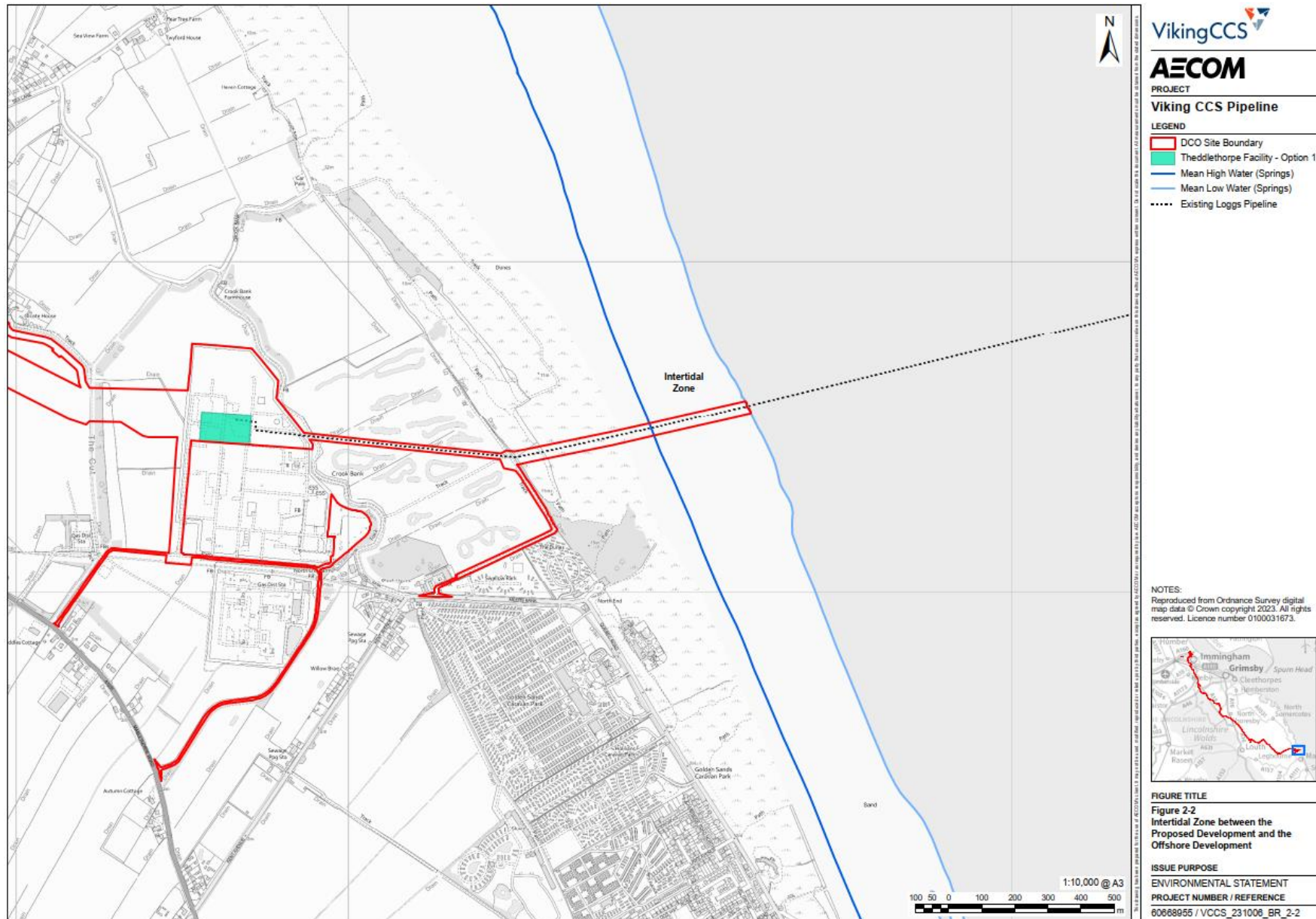
2.4 Intertidal Zone

2.4.1 The Viking CCS Development Project and the Viking CCS Pipeline project boundaries overlap in the intertidal zone. However, it is worth noting that no work is anticipated in this location at all for either the onshore, or offshore projects as the project in this location only consists of the existing buried LOGGS pipeline.

2.4.2 **Figure 2-2** demonstrates the boundary between the Viking CCS Development Project and the Viking CCS Pipeline.

2.4.3 The intertidal zone is defined as the area where the ocean meets the land between high and low tides. This is nominally described in **Figure 2-2** as land between Mean Low Water Spring (MLWS) and Mean High Water Spring (MHWS). The Proposed Development's DCO Site Boundary ends at MLWS, where the Offshore Project commences.

Figure 2-2: Boundary between the Viking CCS Development Project and the Viking CCS Pipeline



2.4.4 The existing LOGGS pipeline which extends through the intertidal zone does not require any intrusive construction works, and the new infrastructure associated with the Offshore Project does not commence until the end of existing LOGGS pipeline, where a new offshore pipeline is proposed, approximately 118km offshore.

2.4.5 Legislation which is applicable to both the Proposed Development and the Offshore Project is presented in **Table 1** which demonstrates the consenting regime associated with the Viking CCS Project as a whole.

Table 1: Overview of the Legislation and Required Consents

Legislation	Consent	Viking CCS Project Aspect	Consent Required?	Authority/Regulator
Infrastructure Planning EIA Regulations 2017 (Ref 2)	Development Consent Order	Viking CCS Pipeline	Development Consent Order required	Planning Inspectorate
Marine and Coastal Access Act (2009) (Ref 15)	Marine Licensing	Viking CCS Development	Marine licence required	Marine Management Organisation (MMO)
Energy Act (2008) (Ref 16)	CCS Leasing		Required for the installation and operation of the Viking CCS Project	Crown Estate
	CCS Licensing		Required for the installation and operation of the Viking CCS Project	NSTA
Conservation of Habitats and Species Regulations (2017) (Ref 17) <ul style="list-style-type: none">• SPAs and SACs• European and UK protected wildlife licenses	Habitat Regulations Assessment	Viking CCS Pipeline	Required to provide the Competent Authority with such information as may reasonably be required 'for the purposes of the assessment' or 'to enable them to determine whether an appropriate	Natural England
Conservation of Offshore Marine Habitat Species	Habitat Regulations Assessment	Viking CCS Development	determine whether an appropriate	Joint Nature Conservation Committee / MMO

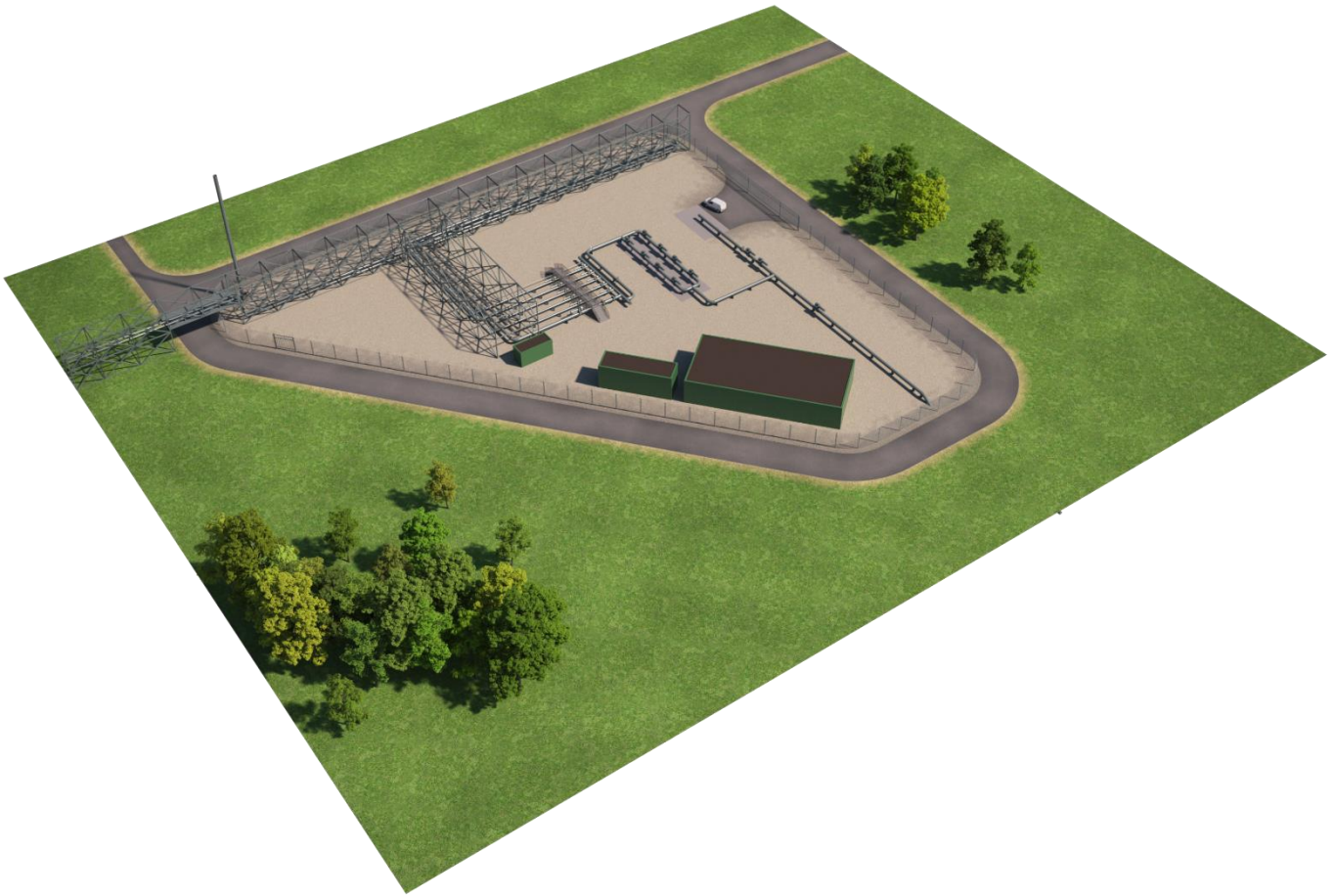
Legislation	Consent	Viking CCS Project Aspect	Consent Required?	Authority/Regulator
<p>Regulations (2017) (Ref 18)</p> <ul style="list-style-type: none"> • SPAs and SACs • European and UK protected wildlife licenses 			assessment is required'.	
<p>Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020) (Ref 19)</p>	EIA	Viking CCS Development	Following acceptance of the ES, consent may be granted by the Secretary of State via the licencing authority.	OPRED

3 Viking CCS Pipeline

3.1 Immingham Facility

- 3.1.1 The first component of the Proposed Development will consist of the Immingham Facility to be located on vacant brownfield land to the south of the VPI Immingham site, formerly used as a construction laydown area for the Immingham power station. This facility would require a relatively small area, consisting of approximately 1.0 hectares (10,000 m²).
- 3.1.2 Provision has been made for approximately five connections from emitters to the Immingham Facility. The facilities to capture, meter and compress any captured CO₂ for transport and connection to the Proposed Development would be performed by the emitters themselves, such as at the Humber refinery operated by Phillips 66, or the Immingham combined heat and power plant operated by VPI (Vitol). Proposals by Phillips 66 and VPI (Humber Zero) are part of separate applications under the Town and Country Planning Act 1990 which are currently being determined by the LPA (North Lincolnshire Council) and, as such, these works do not form part of the Proposed Development. Each emitter would also undertake flow metering and compositional analysis to an agreed specification.
- 3.1.3 The final layout of the Immingham Facility will not be defined until the FEED is undertaken. One potential configuration of the Immingham Facility is shown on **Figure 3-1**. Although the exact location has yet to be finalised, the Immingham Facility will be to the south of the VPI CO₂ capture facilities.
- 3.1.4 The Immingham Facility would include the following key components:
- Inlet manifold with valve access platform;
 - Permanent pig launcher and receiver to allow the onshore CO₂ pipeline to be cleaned and inspected during commissioning and operation and be suitable for intelligent pigging;
 - Common pig handling area for the pig receiver and launcher, which includes a projectile blast wall;
 - High-integrity pressure protection system (HIPPS);
 - Emergency Shutdown Valve (ESDV) for each pipeline and Isolation valves;
 - Venting system including vent pipework, valves and vent stack. Permanent vent stack to be a maximum of 24" diameter and up to 25 metres high;
 - Various instruments installed on the pipework, including temperature, pressure and flow measurement;
 - Central control room (CCR);
 - Local equipment room (LER);
 - Analyser house; and
 - Supporting utilities.

Figure 3-1: Visualisation of the Immingham Facility



3.2 Pipeline

- 3.2.1 The onshore pipeline will be designed in accordance with PD8010 Code of Practice for Pipelines – Part 1 Steel Pipelines on Land (Ref 13) and constructed, operated and maintained in accordance with Pipeline Safety Regulations 1996 (Ref 14). The key design standards, codes and regulations relevant to the design of the Proposed Development are listed in paragraph 3.8.1.
- 3.2.2 The DCO Site Boundary for the application have been developed around an indicative pipeline route. The length of the indicative route within the DCO Site Boundary is approximately 55.6 km and is shown in **Figure 3-2**.
- 3.2.3 The pipeline is expected to have an external diameter of 24" (609 mm) and be buried to a minimum depth of 1.2 m to the top of the pipe. This will be greater at crossing points of railways, roads and watercourses.
- 3.2.4 The pipeline will be constructed in its entirety using thick wall steel pipe. This would consist of either API 5L X70, 24" (DN 600) line pipe with a wall thickness of 29.98mm, or API 5L X80, 24" (DN600) line pipe with a wall thickness of 24.89mm or an equivalent pipeline material.
- 3.2.5 The external coating for the pipeline will be either three layer polyethylene (3PLE) or Fusion Bonded Epoxy (FBE) with a simple multi-component liquid or three layer polypropylene (3LLP) coating applied to protect field joints and tie-ins.

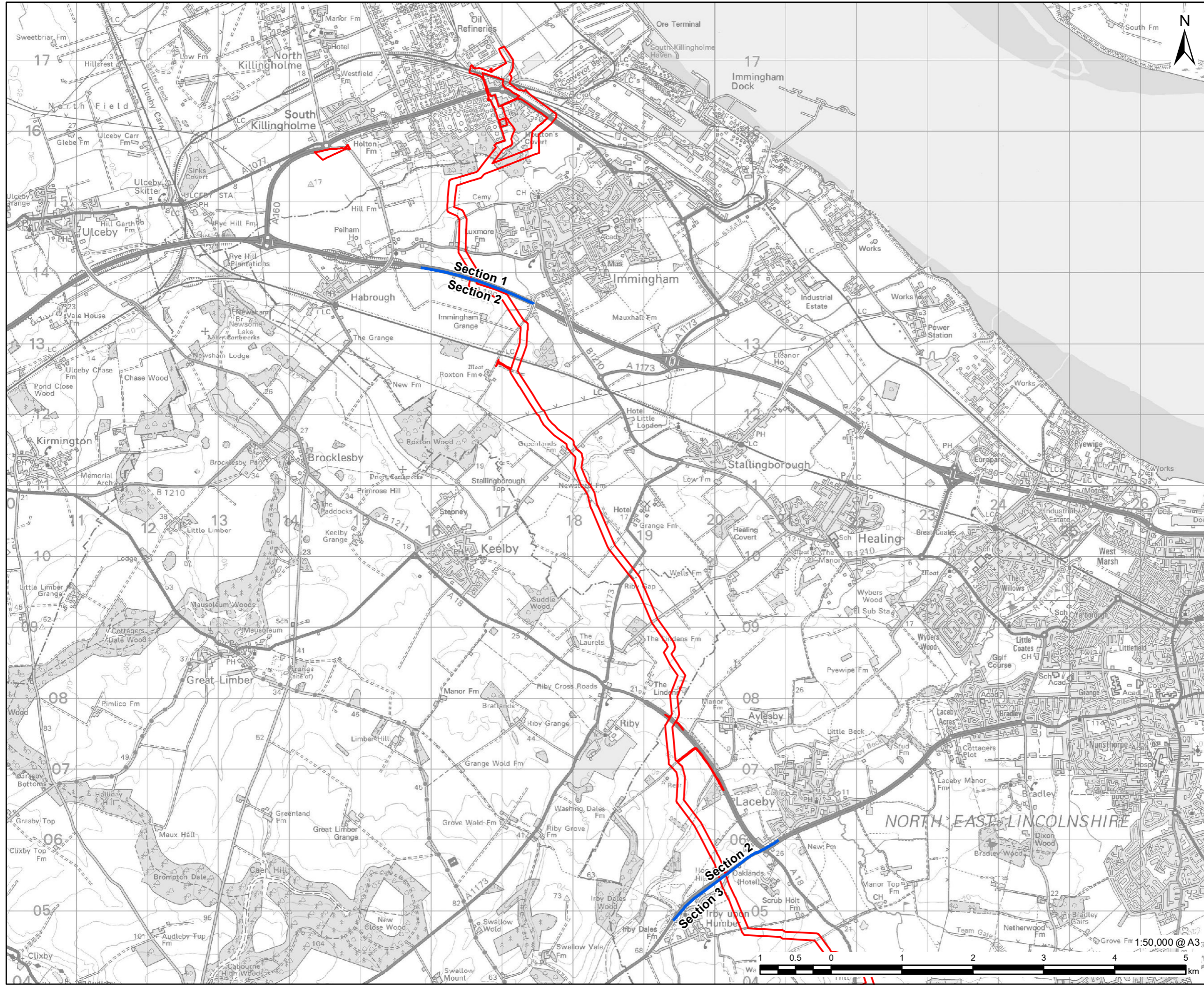
3.2.6 The pipeline system would operate in the following modes:

- *Gas Phase (up to 40 barg)*: Gas phase operation is envisaged to be short-term, potentially following systems commissioning for a period of a few months and is limited to a maximum of 40 barg to avoid two-phase flow in the pipeline; and
- *Dense Phase (100 – 150 barg)*: For most of the operational life, the pipeline will operate in dense phase and pipeline pressure is a function of CO₂ flowrate. The pipeline pressure is kept above 100 barg to avoid two-phase flow in the pipeline. The higher the flowrate, the higher the pressure at the Immingham Facility, up to a maximum of 150 barg.

3.2.7 A summary of the anticipated crossing numbers and types are provided in **Table 2**.

Table 2: Preliminary Crossing Types and Numbers

Crossing type	Trenchless crossings	Open Cut crossings	Total
Buried powerlines	5	7	12
Overhead powerlines	1	23	24
Buried pipelines including: Water pipelines; Wastewater pipelines; Gas pipelines; and Condensate pipelines	8	19	27
Telecoms cables	1	3	4
Hornsea No1 cable and Hornsea No2 cable	0	2	2
Roads	40	6	46
Drains	0	8	8
Railways	2	0	2
Tracks	39	90	129
Rivers	10	2	12
Canal	1	0	1
Total number of crossings			267



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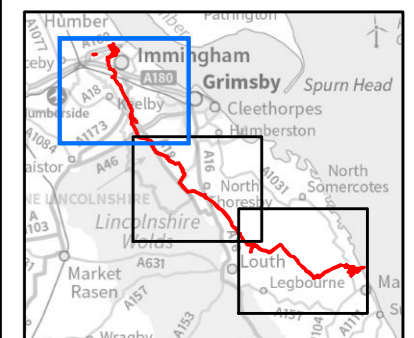
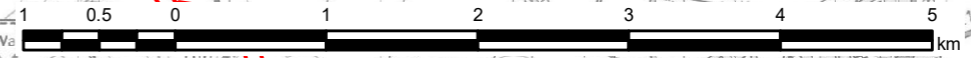
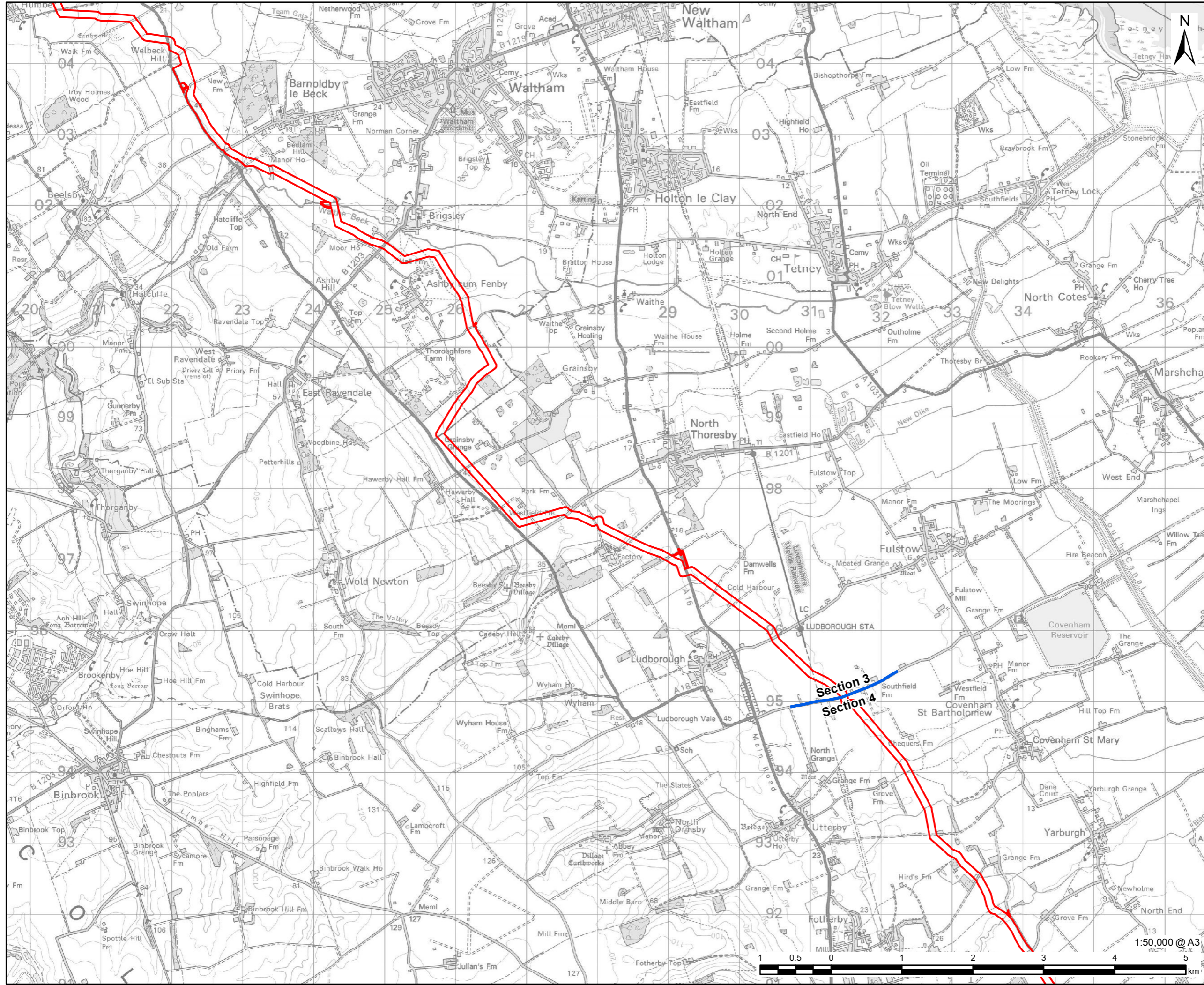


FIGURE TITLE
Figure 3-8 (1 of 3)
DCO Site Boundary

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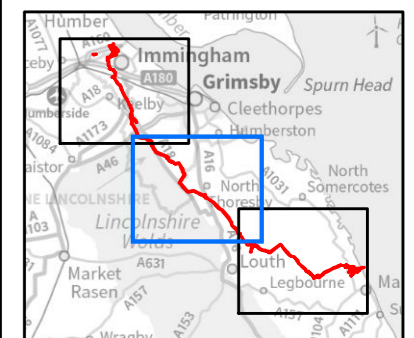
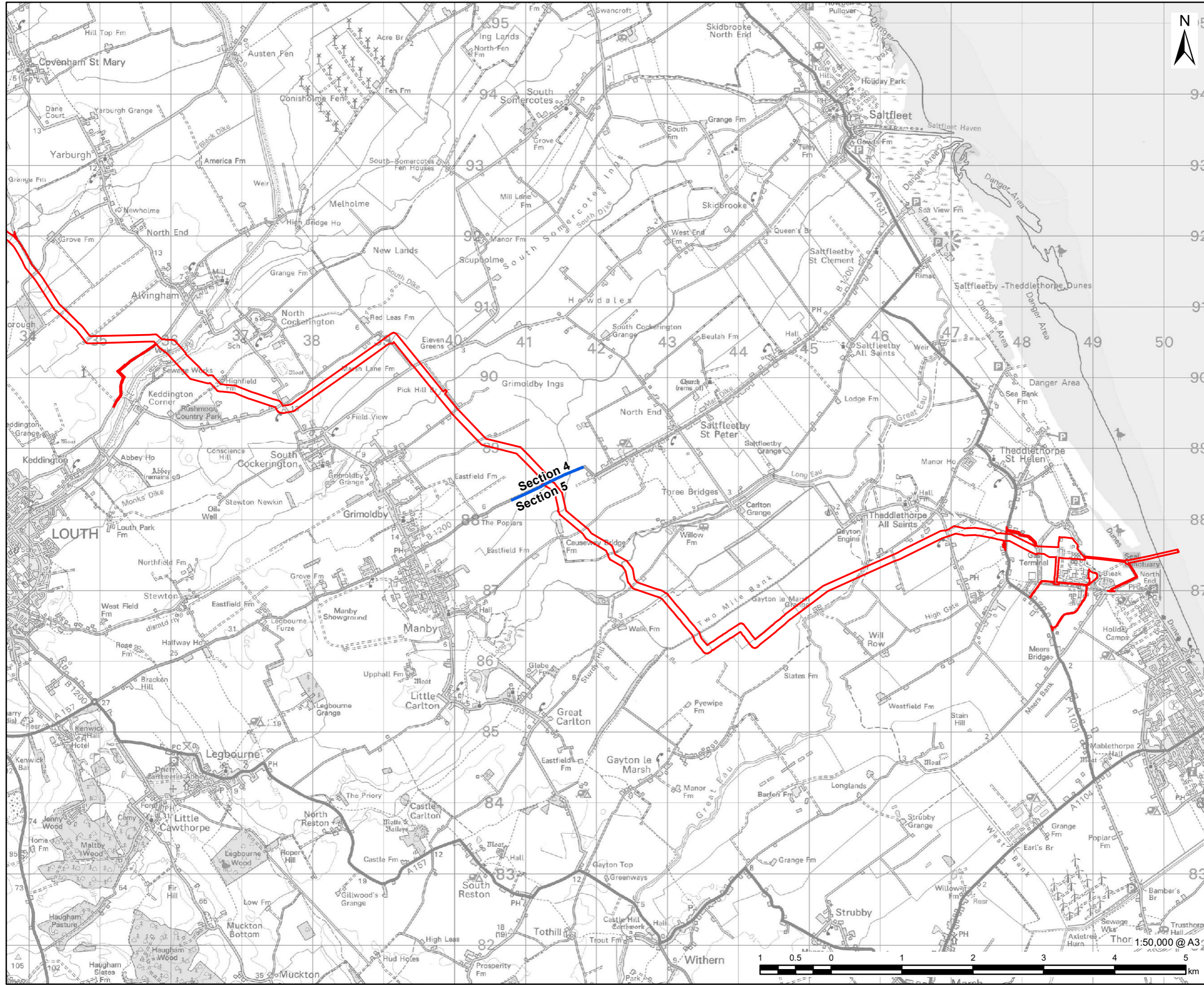


FIGURE TITLE
Figure 3-8 (2 of 3)
DCO Site Boundary

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LEGEND

	DCO Site Boundary
	Route Section Break

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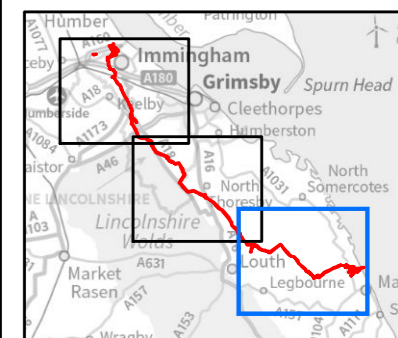
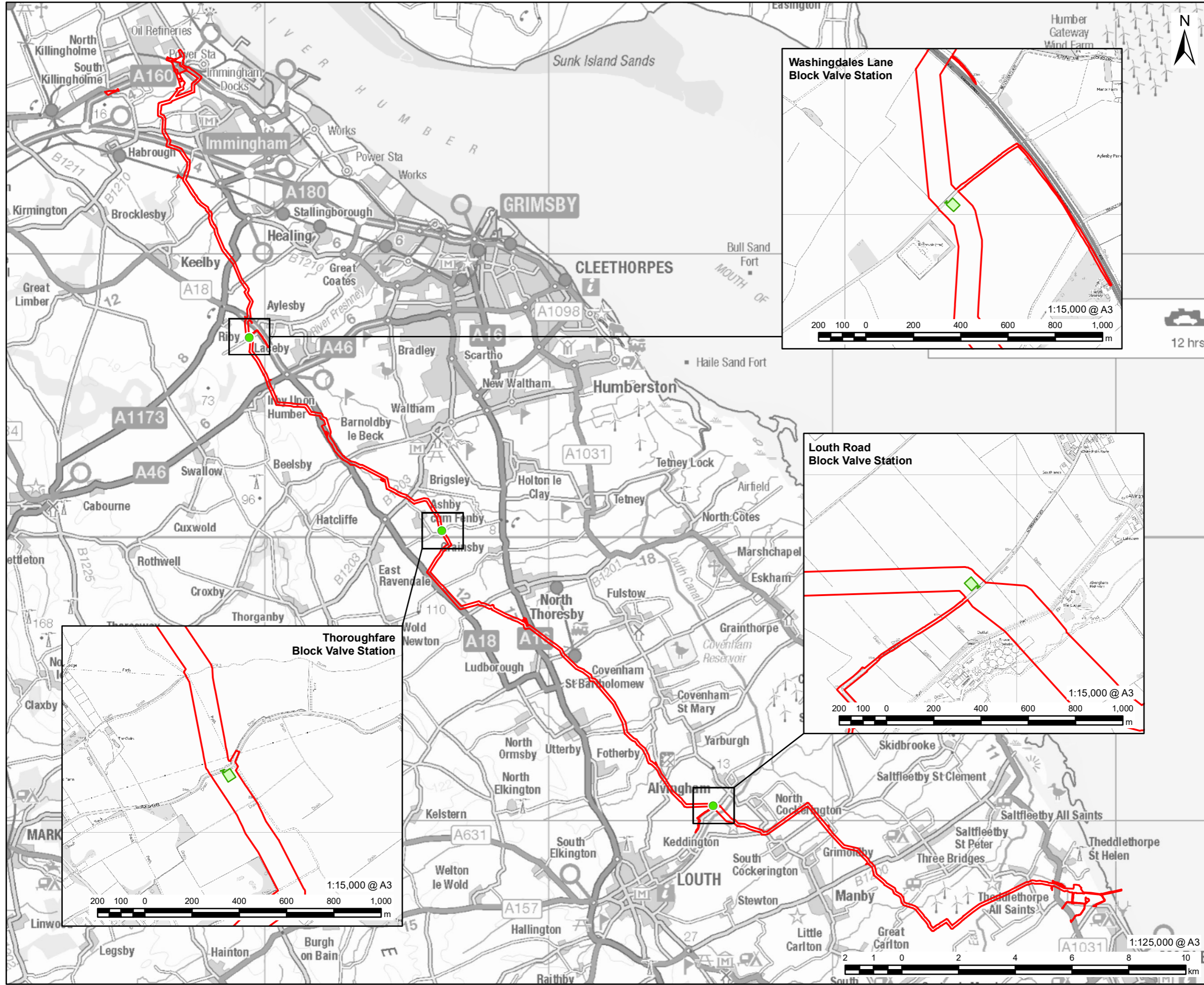


FIGURE TITLE
Figure 3-8 (3 of 3)
DCO Site Boundary

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3.3 Block Valve Stations

- 3.3.1 Three Block Valve Stations are required along the pipeline route to enable pipeline sections to be isolated for operational and maintenance reasons.
- 3.3.2 The spacing of Block Valve Stations was initially recommended using results from Quantitative Risk Assessment which was undertaken using proprietary software. Different spacing lengths and differing numbers of Block Valve Stations were analysed to determine the effect on societal risk along the pipeline route.
- 3.3.3 Further engineering design work has been undertaken to refine and optimise the specific location for the Block Valve Stations along the preferred pipeline route based on the safety case as described in *ES Volume II Chapter 2: Design Evolution and Alternatives (Application Document 6.22)*. This work identified locations at approximately 13 km, 24 km and 39 km along the pipeline route as shown on **Figure 3-3**. The three Block Valve Stations are known as:
- Block Valve Station 1, hereafter called Washingdales Lane Block Valve Station
 - Block Valve Station 2, hereafter called Thoroughfare Block Valve Station; and
 - Block Valve Station 3, hereafter called Louth Road Block Valve Station.
- 3.3.4 Each Block Valve Station would be electrically connected to the National Grid system. The nearest connection points have been identified with the Local Distribution Network Operator (Northern Powergrid) and have been included in the DCO Site Boundary.
- 3.3.5 The Block Valve Stations would include a 10m wide planting strip to provide screening, as per the *Outline Landscape and Ecological Management Plan (Application Document 6.8)*. Outside this visual landscaping, the Block Valve Station will have a smaller 1.5m high three bar, post and rail perimeter fence and access gate. Block Valve Stations would be unlit except during maintenance or potential breakdown/emergency requirements, when task lighting columns (approximately 4 m high) would be employed.
- 3.3.6 The location of the Block Valve Stations is shown on **Figure 3-3**.



VikingCCS

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PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Block Valve Station Location
- Block Valve Station Location

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FIGURE TITLE
Figure 3-10
Location of Block Valve Stations

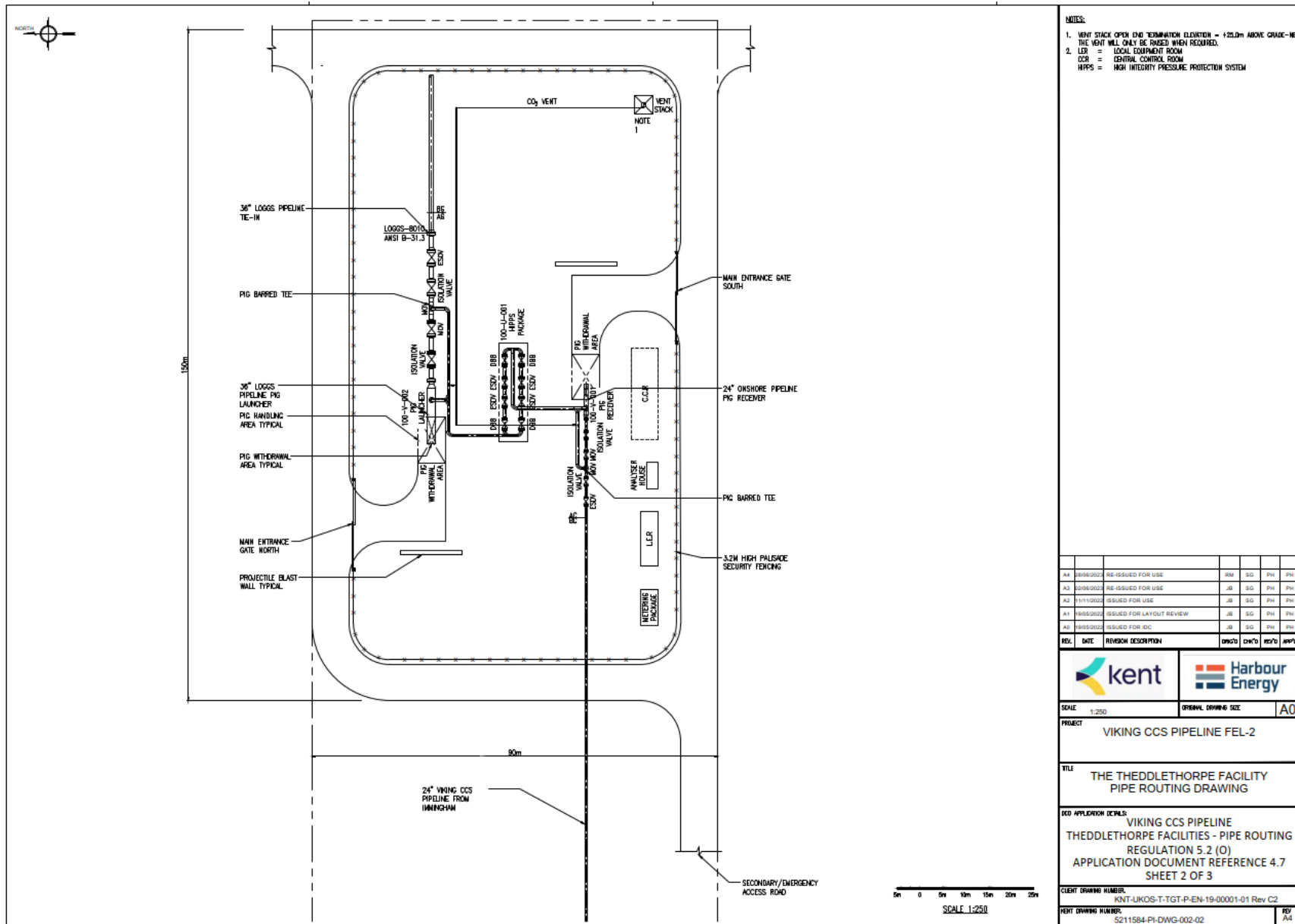
ISSUE PURPOSE
 ENVIRONMENTAL STATEMENT
PROJECT NUMBER / REFERENCE
 60668955 / VCCS_230914_ES_3-10

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3.4 Theddlethorpe Facilities

- 3.4.1 The Theddlethorpe Facility is required to enable the CO₂ to flow from the new 24" pipeline into the existing LOGGS (36") pipeline.
- 3.4.2 There are currently two options for locating the Theddlethorpe Facility, as discussed below.
- 3.4.3 **Option 1:** new facility at the former Theddlethorpe Gas Terminal (TGT) site. Demolition of the former TGT was completed in 2021 but as the site was previously an operational facility, existing security fencing and road infrastructure remain in place. The site is currently clear with a mixture of hard standing, stoned areas and has current access to the existing LOGGS pipeline. Access to the site would be via an existing gate at the south west corner of the site.
- 3.4.4 **Option 2:** Would be a new facility to the west of the former TGT site, located on arable land directly west of The Cut (an ordinary watercourse). This facility would be accessed from the north off the A1031 Mablethorpe Road.
- 3.4.5 The Theddlethorpe Facilities would comprise the following key components:
- LOGGS pipeline tie-in;
 - Emergency Shutdown Valves;
 - Pig receiver and launcher;
 - High-integrity Pressure Protection System;
 - Venting system including vent pipework, valves, and vent stack;
 - Local equipment room (LER); and
 - Supporting Utilities.
- 3.4.6 The Theddlethorpe Facility would be secured by a single mesh (e.g., weldmesh fencing), security fence 3.2 m high.
- 3.4.7 The ground surface within the boundary of the Theddlethorpe Facility will be predominantly stone with a minimal number of internal tarmac/concrete access roads.
- 3.4.8 A schematic of the Theddlethorpe Facility is shown in **Figure 3-4**.
- 3.4.9 A more detailed description of the Proposed Development is provided in *ES Volume II Chapter 3 Description of the Proposed Development (Application Document 6.2.3)*.

Figure 3-4: Schematic of the Theddlethorpe Facility



4 Viking CCS Pipeline EIA - Summary of Environmental Effects

4.1 Ecology and Biodiversity

4.1.1 Statutory and non-statutory designated sites of international, national and county importance were taken forward to impact assessment. These include:

- Five internationally designated sites including:
 - the Humber Estuary Special Protection Area;
 - the Humber Estuary Ramsar
 - Saltfleetby-Theddlethorpe Dunes and Gibraltar Point Special Area of Conservation;
 - Greater Wash Special Protection Area with marine components; and
 - Humber Estuary Special Area of Conservation;
- 15 nationally designated sites; including Sites of Special Scientific Interest, National Nature Reserves and Local Nature Reserves; and
- 33 non-statutory designates sites; these designations include Local Wildlife Sites, Sites of Nature Conservation Interest, Local Wildlife Trust sites or Roadside Nature Reserve sites.

4.1.2 Only features of county and local importance and above were taken forward to impact assessment. These included the following habitats:

- Open mosaic habitat on previously developed land – local importance;
- Semi-natural broadleaved woodland – local importance;
- Broad-leaved plantation woodland – local importance;
- Woodpasture and parkland – county importance;
- Hedgerows – local importance;
- Scattered trees – local importance;
- Veteran Trees – National importance;
- Semi-improved grassland – local importance;
- Running water – local and county importance;
- Open water (ponds) – local importance; and
- Dune grassland, Dune Scrub and Open Dune – international importance.

4.1.3 The following protected species or species groups were identified to be of local importance and above and were therefore taken forward to impact assessment:

- *Terrestrial invertebrates* (county importance);
- *Great Crested Newt* (county importance);
- *Common toad* (local importance);
- *Reptiles* (local importance);

- *Fish* (county importance);
- *Birds* (national importance);
- *Roosting bats* (local importance);
- *Foraging and commuting bats* (local importance);
- *Otter* (county importance);
- *Water vole* (national importance);
- *Brown hare* (local importance);
- *Hedgehog* (local importance);
- *Badger* (local importance);
- *Aquatic macroinvertebrates and macrophytes* (local importance); and
- *Invasive non-native species* (negligible, but a legal offence to plant or otherwise allow to spread in the wild).

4.1.4 During construction, operation and/or decommissioning of the Proposed Development, potential impacts on the ecological receptors identified above could include habitat loss or damage, noise and vibration disturbance, visual disturbance, emissions and artificial lighting.

4.1.5 During the construction phase, the assessment has determined that there would be **no Significant effects** to statutory and non-statutory designated sites, features of county and local importance, or protected species except for Great Crested Newt. There would be a **Significant** beneficial effect on Great Crested Newt during the construction phase, due to the mitigation which would be in place due to the District Level Licensing.

4.1.6 During the operational and decommissioning phases, the assessment has determined all potential effects would be **Not Significant**.

4.1.7 Biodiversity Net Gain, or “BNG”, Statutory requirements do not apply to the Proposed Development. However, the Applicant is committed to making a positive contribution to biodiversity net gain and is making a voluntary commitment.

4.2 Landscape and Visual

4.2.1 During the construction phase, the introduction of construction activity including vehicle movement, signage, fencing, excavations, earth movements, removal of vegetation and agricultural land may have potential effects on tranquillity. Landscape elements could be lost as a result of the removal of trees and vegetation and the landscape pattern of the area could change due to the removal of field boundary hedgerows. Visual receptors could experience a change in character as a result of the introduction of construction activities and the removal of landscape features.

4.2.2 During the construction phase, there is the potential for temporary impacts on landscape and visual receptors from a number of construction activities including:

- construction of the temporary access routes and three main compounds,
- the site clearance associated with the construction of the pipeline and above ground facilities and Block Valve Stations; and
- localised temporary lighting during short daylight hours.

4.2.3 During the operational phase, the potential impacts include:

- Presence and operation of a number of permanent structures including vents at the Immingham Facility and the Theddlethorpe Facility; and
- Gaps in hedgerows and other boundary vegetation as a result of vegetation removal during the construction stage including the presence of newly planted reinstatement planting around the Block Valve Stations, Immingham Facility and the Theddlethorpe Facility. These would regrow and so expected to only be short term.

4.2.4 During the decommissioning phase, the potential impacts include:

- The removal of infrastructure at the Immingham Facility, Theddlethorpe Facility and the Block Value Stations.

4.2.5 The assessment has determined that there are no significant impacts at any of the identified landscape receptors during any stage of the development.

4.2.6 The assessment of visual impacts has determined that the viewpoints listed below are likely to experience significant short-term adverse effects during the construction phase.

- Viewpoint 6 (Public Right of Way NELC 16 Walk Lane, Irby Upon Humber);
- Viewpoint 7 (Public Right of Way NELC 17 Welbeck Hill);
- Irby Upon Humber (Lincolnshire Wolds Area of Outstanding Natural Beauty);
- Viewpoint 8 (Public Right of Way NELC 122 Welbeck Hill);
- Irby Upon Humber (Lincolnshire Wolds Area of Outstanding Natural Beauty); and
- Users of the heritage railway at Viewpoint 17 (Station Road, Ludborough).

4.2.7 This is because of the high sensitivity of these particulars Public Rights of Way, the Lincolnshire Wolds Area of Outstanding Natural Beauty and the heritage railway in Ludborough.

4.2.8 They are also in close proximity to the construction operations associated with the pipeline route and there is limited existing vegetation to screen the construction activity. Although the mitigation measures set out above would assist in reducing the impacts at these locations, the reduction would be insufficient to reduce the impact rating and therefore effects to below significant levels.

4.2.9 During the decommissioning phase, effects as a result of the Proposed Development are expected to be similar or less than the effects described during the construction phase. The assessment presented for the construction phase in relation to the landscape and visual assessment is therefore considered to be representative.

4.2.10 The full assessment can be found in *ES Volume II Chapter 7 Landscape and Visual (Application Document 6.2.7)*.

4.3 Historic Environment

4.3.1 Where the pipeline can be routed within the DCO Site Boundary to avoid or preserve archaeological remains, the residual effects would not be considered significant.

4.3.2 The historic environment assessment has identified likely significant residual effects on non-designated buried archaeological remains at one site due to construction of the pipeline:

- Section 5 – cropmark enclosures at Theddlethorpe [622].

4.3.3 The archaeological site affected relates to medieval settlement activity. The significant residual effects identified are assessed as Moderate adverse permanent effects.

- 4.3.4 Residual effects on other buried archaeological remains would be Minor or Negligible adverse: these permanent effects are not considered to be significant.
- 4.3.5 These assessments reflect the sensitivity (value) of the heritage assets affected and the scale of impact (change), taking into account the ability to minimise impact within the DCO Site Boundary by careful routing of the pipeline and reduction in the working width.
- 4.3.6 On the basis of the baseline established in section 8.5 above, it is possible that unidentified archaeological remains may be encountered within the DCO Site Boundary. Where these are encountered, these could vary in value from Very Low to High value. Where these archaeological remains are removed by the construction of the Proposed Development then it would result in a High magnitude of impact and a range of effects would result from Negligible adverse to Major adverse.
- 4.3.7 The historic environment assessment has identified likely significant residual effects on three designated heritage assets, the grade II* listed Church of St Edmund in Riby, the grade II listed Ashleigh Farm at Theddlethorpe, and the grade II listed Manor House and non-designated former parkland at Barnoldby le Beck due to construction of the pipeline. The significant residual effects identified are assessed as Moderate adverse effects, which would be temporary during the construction phase, and would be transient, reducing as construction progresses. Residual effects on other built heritage assets due to construction of the Proposed Development are assessed as Minor or Negligible adverse: these temporary effects are not considered to be significant.
- 4.3.8 The full assessment can be found in *ES Volume II Chapter 8: Historic Environment (Application Document 6.2.8)*.

4.4 Geology and Hydrogeology

- 4.4.1 During the construction phase, potential impacts as a result of the Proposed Development includes but is not limited to, chemical spillage, potential dewatering, changes in subsoil structure, subsoil compaction and the disturbance of contaminated soil. Effects as a result of the Proposed Developments construction have all been assessed as Not Significant following implementation of additional mitigation.
- 4.4.2 During the operational phase, potential impacts as a result of the Proposed Development include potential dewatering (though not anticipated), new foundations and structures creating new preferential pathways for contaminants and aggressive ground contaminants posing a risk to the pipeline. Effects as a result of the Proposed Development operation have all been assessed as Not Significant following implementation of additional mitigation.
- 4.4.3 During the decommissioning phase, the effects will be similar to that experienced during construction, therefore there is no need for additional mitigation or enhancement proposed with respect to geology and hydrogeology when compared to the construction phase. The assessment of residual effects will be the same as for construction phase.
- 4.4.4 The full assessment can be found in *ES Volume II Chapter 9: Geology and Hydrogeology (Application Document 6.2.9)*.

4.5 Agriculture and Soils

- 4.5.1 During the construction phase, the permanent loss of Best and Most Versatile land is expected to be less than 5 hectares and would be attributed to the development of Theddlethorpe Facility (Option 2) and its access as well as the three Block Valve Stations. It is calculated that the permanent loss of agricultural land would be approximately 0.2 hectares of Grade 2 agricultural land and 2.0 hectares of Subgrade 3a agricultural land. The permanent loss of any Grade 2 agricultural land is considered to be Significant.

- 4.5.2 During the construction phase, there would be temporary and reversible loss of agricultural land including Grade 2 agricultural land, Subgrade 3a agricultural land and Subgrade 3b agricultural land. Industry standard good practice measures such as those set out in the Outline Soil Management Plan (*ES Volume II Appendix 10-1 (Application Document 6.4.10.1)*) will ensure that the land is restored to its former condition (or better). Therefore, this effect is considered to be Not Significant.
- 4.5.3 Construction activities would also temporarily disturb soils, but the mitigation measures presented in the Outline Soil Management Plan would ensure that the soils resource is protected and maintained.
- 4.5.4 During the operational phase, activities with the potential to impact upon agriculture and soils, i.e., maintenance and emergency repairs, will be limited and will be of a significantly smaller scale than experienced during the construction phase. Therefore, with the agreement with the Planning Inspectorate, operational effects have been scoped out.
- 4.5.5 During the decommissioning phase, the scale and nature of activities undertaken would be similar to those described previously for construction, and they would be temporary during the period of decommissioning activities on site. Following the removal of the structures and the reinstatement of the land there would be no further potential effects on agricultural land and soil resources. Therefore, effects from the Proposed Development during decommissioning are expected to be Not Significant.
- 4.5.6 The full assessment can be found in *ES Volume II Chapter 10: Agriculture and Soils (Application Document 6.2.10)*.

4.6 Water Environment

- 4.6.1 During the construction phase, there is a risk of pollution to surface water from construction activities involving polluting substances such as fuels, cement and other chemicals as well as from excessive fine sediment in runoff from the disturbance of soil during earthworks. There are potential effects to flood risk associated with construction activities and to the construction workforce should waterbodies flood.
- 4.6.2 With the incorporation of embedded design mitigation and additional mitigation, effects due to the construction of the Proposed Development are expected to be Not Significant.
- 4.6.3 During the operational phase, the following water environment impacts may occur:
- Impacts on water quality in waterbodies that may receive surface water runoff or be at risk of chemical spillages from above ground facilities for the Project (e.g., Immingham Facility) from diffuse pollutants in runoff, operational discharges and the risk of chemical spillages;
 - Hydromorphological impacts to waterbodies including changes to physical form which underpin habitats;
 - Impacts on flood risk from increased runoff from new impervious areas at above ground facilities for the Proposed Development;
 - Potential impacts on hydrology as a result of the Proposed Development by changing the way water infiltrates into the ground and supports baseflow to waterbodies; and
 - Permanent loss of floodplain within areas classified as Flood Zone 2 and 3.
- 4.6.4 With the implementation of embedded mitigation (e.g., the drainage strategy) and additional mitigation, the routine operation of the Proposed Development is not considered to have significant effects on the water environment as the principal watercourses crossed by the Proposed Development would be non-intrusive and drilled / bored beneath the bed at a

sufficient depth to avoid exposure. Effects due to the operation of the Proposed Development are expected to be Not Significant.

- 4.6.5 During the decommissioning phase, effects would be expected to be similar (albeit perhaps on a smaller scale) to the construction effects already described and could result in a temporary risk of pollution to surface water and potential effects to flood risk. The decommissioning phase would apply similar design and mitigation measures as the Construction Phase. Standard pollution prevention and construction best practices would be adopted to mitigate potential impacts upon the water environment where required and reasonably practicable.
- 4.6.6 The full assessment can be found in *ES Volume II Chapter 11: Water Environment (Application Document 6.2.11)*.

4.7 Traffic and Transport

- 4.7.1 Only the construction phase of the Proposed Development has been assessed, with two scenarios assessed; neither the operational nor decommissioning phases were considered, in line with the proposed scope. The assessment is based upon construction traffic information provided to which a 20% uplift has then been applied to provide a substantial level of robustness and flexibility to the assessment.
- 4.7.2 Based on the current understanding of traffic and transport associated with the Proposed Development, significant effects are anticipated on 5 construction routes.
- 50 - Grimsby Road (Section 3);
 - 51 - Grimsby Road (Section 3);
 - 52 - A1031 (Section 3);
 - 53 - A1031 Main Road (Section 4); and
 - 54 - Warren Road (Section 4).
- 4.7.3 It should then be noted that the magnitude as based upon the assessment above do not take account of any further measures adopted by the contractor to reduce traffic levels during the construction phase through the Contractor's CTMP.
- 4.7.4 Therefore, the assessment does not take account of any car sharing by construction workers, or the potential for the contractor to use mini buses to transport workers from key destinations directly to the working area, and both of these measures would then reduce the number of construction worker trips.
- 4.7.5 It is likely that such measures would reduce potential effects further; however, as these measures cannot be detailed until a contractor is appointed, the residual significance reported below does not include these measures.
- 4.7.6 The full assessment can be found in *ES Volume II Chapter 12: Traffic and Transport (Application Document 6.2.12)*.

4.8 Noise and Vibration

- 4.8.1 During the construction phase, there may be noise and vibration impacts from the construction activity, such as from the operation of machinery and plant. There may also be noise and vibration impacts from construction traffic.
- 4.8.2 During the construction phase, after the implementation of additional mitigation measures there are not anticipated to be any significant effects from construction noise. It is also assessed that there will be potential for exposure to high levels of vibration from construction

activities, but it is anticipated that this activity will not last longer than a day, and therefore vibration effects during the construction phase are considered Not significant.

- 4.8.3 Effects in relation to construction traffic are also expected to be Not Significant.
- 4.8.4 During the operational phase, noise and vibration from the operation of the Proposed Development would include the limited noise from the operation of electrical and mechanical equipment at the facilities and Block Valve Stations. Effects from the Proposed Development operation are expected to be Not Significant.
- 4.8.5 During the decommissioning phase, noise effects of the Project will be similar or less than noise effects during the construction phase. The noise assessment presented for the construction phase is therefore considered representative (or an overestimate) of the decommissioning phase.
- 4.8.6 The full assessment can be found in *ES Volume II Chapter 13: Noise and Vibration (Application Document 6.2.13)*.

4.9 Air Quality

- 4.9.1 During the construction phase, there are potential effects on air quality due to construction dust, construction plant emissions and construction traffic emissions.
- 4.9.2 In relation to air quality, effects are expected to be Not Significant due to the application of industry standard guidance and effective mitigation. Dust soiling and ecological receptors are considered to be at medium to low risk of dust impacts, while human health receptors are considered to be a low – negligible risk from dust impacts. It is expected that effects on local air quality would be Not Significant as a result of construction traffic movements associated with the Project.
- 4.9.3 Air quality effects during the operational and decommissioning phase of the Proposed Development have been scoped out from further assessment. Emissions in this operational phase would be restricted to occasional maintenance activities and would not affect air quality objectives.
- 4.9.4 The full assessment can be found in *ES Volume II Chapter 14: Air Quality (Application Document 6.2.14)*.

4.10 Climate Change

- 4.10.1 For the Greenhouse Gas Emissions Assessment, where data is available greenhouse gases that would be emitted over the life of the Proposed Development have been predicted. The large majority of the emissions are associated with the embodied carbon of the construction materials being used for the Proposed Development.
- 4.10.2 These have been compared against the existing baseline of greenhouse gas emissions. Comparing these figures as a percentage of the relevant UK Carbon Budget for the time period shows the Proposed Development impact on climate is expected to be Not Significant.
- 4.10.3 The Proposed Development forms part of a wider Viking CCS Project to abate carbon emissions from large industrial emitters at the Immingham Industrial Site. This broader project will result in significant reductions in carbon emissions and is expected to give a Significant Beneficial effect.
- 4.10.4 The Climate Change Resilience Assessment has been qualitative and provides commentary on how the Proposed Development will be resilient to climate change within the context of current and predicted future climate conditions. Effects are expected to be Not Significant.

4.10.5 The full assessment can be found in *ES Volume II Chapter 15: Climate Change (Application Document 6.2.15)*.

4.11 Socio-economics

4.11.1 During the construction phase, the Proposed Development is expected to create temporary employment opportunities, both directly at work sites and indirectly in the supply chain and gross value would be added to businesses in the Proposed Development area. There would also be the creation of training opportunities and apprenticeships, including opportunities to upskill local residents during construction. This means there would be a minor beneficial effect on employment. Additionally, the construction phase is expected to contribute approximately £13,900,000 to the local economy, another minor beneficial effect.

4.11.2 During the construction phase, there are not expected to be any significant effects on:

- Training and apprenticeships;
- Severance/disruption of access to users of community facilities/residents of nearby settlements;
- Residential properties, business premises, community facilities, visitor attractions, open space;
- Public Rights of Way; and
- Development land.

4.11.3 Socio-economic effects during the operation phase have been scoped out of the assessment.

4.11.4 During the decommissioning phase of the Proposed Development, there is not expected to be any significant effects.

4.11.5 The full assessment can be found in *ES Volume II Chapter 16: Socio-economics*.

4.12 Health and Wellbeing

4.12.1 During the construction phase, the Proposed Development is not expected to have any significant effects on access to healthcare services and other social infrastructure, Air quality, noise, and neighbourhood amenity, accessibility and active travel, access to work and training, or social cohesion and neighbourhoods.

4.12.2 During the operational phase, the Proposed Development is not expected to have negligible to no effect on the aforementioned receptors.

4.12.3 During the decommissioning phase, the effects are expected to be the same or less than that experienced in the construction phase.

4.12.4 The full assessment can be found in *ES Volume II Chapter 17: Health and Wellbeing*.

4.13 Materials and Waste

4.13.1 During the construction phase, the potential impacts on materials and waste as a result of the Proposed Development are expected to be:

- Changes in landfill capacity;
- Changes in demand for materials; and
- Impacts on safeguarded waste sites and associated access.

4.13.2 These impacts have been assessed and their effects are deemed to be not significant on material and waste receptors.

4.13.3 The full assessment can be found in *ES Volume II Chapter 18: Materials and Waste (Application Document 6.2)*.

4.14 Major Accidents and Disasters

4.14.1 Following receipt of the Scoping Opinion (*ES Volume IV Appendix 5.2 (Application Document 6.4)*), the following items were confirmed by the Planning Inspectorate to be scoped into the major accidents and disasters assessment:

- **Natural Hazards:**

- *Geophysical*: landslides, sinkholes;
- *Hydrology*: tidal flooding, fluvial flooding;
- *Climatological and Meteorological*: wave surges; and
- *Biological*: animal diseases

- **Technological or Manmade Hazards:**

- *Major Accident Hazard Chemical sites*: Major Accident Hazard Chemical sites, Major Accident Hazard Pipelines, fires;
- *Pollution accidents*: Air; and
- *Malicious Attacks*: cyber, flood defence failure.

4.14.2 During the construction and operational phase, the assessment identified risks and whether these are able to be managed to be As Low as Reasonably Practicable or whether further mitigation would be required. All effects identified for these phases of the Proposed Development are expected to be As Low as Reasonably Practicable and therefore tolerable and Not Significant.

4.14.3 Decommissioning of the Proposed Development is not specifically included as the hazards are anticipated to be encompassed by those assessed for the construction and operation phase, and no additional decommissioning hazards have been identified.

4.14.4 The full assessment can be found in *ES Volume II Chapter 20: Major Accidents and Disasters*.

4.15 Embedded Mitigation

4.15.1 Embedded mitigation are mitigation measures which have been identified and adopted as part of the evolution of the Proposed Development design, the design has been developed and informed to reflect the findings of the environmental studies, comments raised during the consultation process and ongoing engagement with stakeholders.

4.16 Additional Mitigation Measures

4.16.1 The Draft Construction Environmental Management Plan (CEMP) aims to set out the mitigation measures identified to help avoid or reduce adverse environmental effects during the Proposed Development's construction phase whilst also setting out applicable environmental legislation which needs to be complied by the Contractor who builds the Proposed Development.

4.16.2 It is called a Draft CEMP when it is submitted with the DCO application, as it would need to be finalised by the appointed Contractor prior to the start of construction, based on a detailed

project design and construction programme. The Final (or construction issue) Construction Environmental Management would cover all construction activities, clearly set out roles and responsibilities and provide contact details for key personnel. A requirement would be included within the Development Consent Order, which would state that the Final Construction Environmental Management Plan would need to be submitted to and approved by the relevant local authorities.

- 4.16.3 The iteration included in *ES Appendix 3-1 Draft CEMP (Application Document 6.4.3.1)* and has been produced to support the ES and the assessment within.

4.17 Habitat Regulations

- 4.17.1 Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) (the 2017 Regulations) states that:

“A competent authority, before deciding to ... give any consent for a plan or project which is likely to have a significant effect on a European site ... must make an appropriate assessment of the implications for the plan or project in view of that site’s conservation objectives... The competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site.”

- 4.17.2 The Habitats Directive (Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) protects habitats and species of European nature conservation importance. Together with the Birds Directive (Directive 2009/147/EC on the conservation of wild birds), the Habitats Directive establishes a network of internationally important sites designated for their ecological status.
- 4.17.3 A screening exercise was undertaken to screen out those aspects of a project and / or the European sites that can, without any detailed appraisal, be said to be unlikely to result in significant adverse effects upon European sites, usually because there is no mechanism for an adverse interaction (i.e., a pathway) with European sites. Any remaining aspects are then taken forward to Appropriate Assessment. The assessment must consider the potential for effects ‘in combination’ with other plans and projects.
- 4.17.4 On the basis of HRA Stage 2 – Appropriate Assessment, it is concluded that the adverse effects of the Proposed Development (with regard to all Route Sections) on the integrity of the Humber Estuary SPA and Ramsar and Saltfleetby – Theddlethorpe Gibraltar Point SAC can be excluded, both alone and in combination with other projects or plans. Therefore, consent can be granted without the need to consider a derogation under the Habitats Regulations

4.18 Water Framework Directive

- 4.18.1 An impact assessment of any works/modifications to water bodies in the UK is required under the European Union’s Water Framework Directive (2000/60/EC) (WFD). The WFD was transposed into UK law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (**Ref 12**). The WFD aims to protect and enhance the water environment.
- 4.18.2 The WFD takes a holistic approach to sustainable management of the water environment by considering interactions between surface water, groundwater and water-dependent ecosystems. Ecosystem conditions are evaluated according to interactions between classes of biological, chemical, physico-chemical and hydromorphological elements known as ‘Quality Elements’.

- 4.18.3 Under the WFD, 'water bodies' are the basic management units, defined as all or part of a river system or aquifer. Water bodies form part of a larger 'river basin district' (RBD), for which 'River Basin Management Plans' (RBMPs) are used to summarise baseline conditions and set broad improvement objectives. RBMPs are produced every six years, in accordance with the river basin management planning cycle. The current RBMPs at the date of this assessment (September 2022) are the 2015 Cycle 2 plans. The Cycle 3 RBMPs are currently draft, however the baseline will be updated once current.
- 4.18.4 In England, the Environment Agency (EA) is the competent authority for implementing the WFD, although many objectives are delivered in partnership with other relevant public bodies and private organisations, for example local planning authorities, water companies, rivers trusts, and private landowners and developers.
- 4.18.5 The EA is also responsible for managing flood risk and other activities on Main Rivers. Local planning authorities or drainage boards are responsible for consenting certain activities on Ordinary Watercourses. Local planning authorities are responsible for highways drains, and landowners are responsible for ditches and watercourses and also piped watercourses and culverts. While the EA is ultimately responsible for the WFD on any water body, local authorities are required to plan and consent WFD related activities on Ordinary Watercourses.
- 4.18.6 As part of its regulatory and statutory consultee role on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2016) (**Ref 12**), the EA and WFD-partnering organisations, must consider whether proposals for new developments have the potential to:
- Cause a deterioration of any quality element of a water body from its current status or potential; and / or
 - Prevent future attainment of good status or potential where not already achieved.
- 4.18.7 Regulation 17 of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (i.e., the WFD) states that, like other public bodies, local authorities have a statutory duty to "have regard to the River Basin Management Plan" and "any supplementary plans" covering proposed activities when exercising its functions. Local authorities must therefore reflect water body improvement priorities as outlined in RBMPs.
- 4.18.8 In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the EA and partnering organisations must also consider the conservation objectives of any Protected Areas (i.e., water dependent Sites of Special Scientific Interest) and adjacent WFD water bodies, where relevant.
- 4.18.9 The Proposed Development interacts with 13 Water Framework Directive (WFD) water bodies and two groundwater bodies and thus it is necessary to consider the activities and constituent parts of the Proposed Development to determine compliance with WFD objectives. This includes assessing the impact of the pipeline crossings and supporting infrastructure on the biological, physico-chemical and hydromorphological quality elements that comprise the WFD to ensure no deterioration and no prevention of future improvement in water body status. Both surface and groundwater bodies are considered.
- 4.18.10 In accordance with the Planning Inspectorate's Advice Note Eighteen, a three-stage approach has been adopted:
- **Stage 1: WFD Screening** - Identification of the proposed work activities that are to be assessed and determination of which WFD water bodies could potentially be affected through identification of a Zone of Influence. This step also provides a rationale for any water bodies screened out of the assessment.

- **Stage 2: WFD Scoping** - For each water body identified in Stage 1, an assessment is carried out to identify the effects and potential risks to quality elements from all activities. The assessment is made taking into consideration embedded mitigation (measures that can reasonably be incorporated into the design of the proposed works) and good practice mitigation (measures that would occur with or without input from the WFD assessment process).
- **Stage 3: WFD Impact Assessment** - A detailed assessment of the water bodies and activities carried forward from the WFD screening and scoping stages.

4.18.11 The following mitigation was considered during the assessment;

- The CEMP and WMP will be followed for the installation of onshore pipelines and watercourse crossings for site access. They outline measures which will be taken to prevent the ingress of fine sediment or other material to, and the pollution by sediment of, any existing watercourse. This will include storage of excavated material at the edge of the working area and heaped such that the spoil heap does not encroach outside the fenced area and the creation of raised soil platforms for Bailey bridges will be set back from the watercourse.
- Intrusive crossings and watercourse crossings for site access will be carried out in dry weather when flow is at its lowest. Reinstated banks will be covered with biodegradable matting and seeded as soon as practicable to reduce risk of bank erosion and delivery of fine sediment and organic material to water bodies.
- Launch and receive pits for non-intrusive crossings will be located at least 10m away from the watercourse (edge of normal flow) to reduce the risk of pathways being created for runoff or pollutants to enter water bodies. For sensitive water crossings, the Working Width will be reduced to 10 metres.

4.18.12 With this proposed mitigation in place, it is not expected that there would be any deterioration in the status of the water bodies and would not prevent the water bodies achieving Good Ecological Status and Good Ecological Potential.

4.18.13 For more detailed information refer to *ES Volume IV Appendix 11.3 WFD Assessment (Application Document 6.4.11.3)*.

4.19 Flood Risk Assessment (FRA)

Background

- 4.19.1 The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Change PPG specify that applications for development proposals greater than 1 hectare (ha) in area, or located in Flood Zone 2 and 3, should be accompanied by a FRA that identifies and assesses all forms of flooding to and from the Proposed Development. A FRA should demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking into account the vulnerability of the Proposed Development and the potential impact of climate change on risk.
- 4.19.2 The EA's Flood Map for Planning (Rivers and Sea) indicates that the DCO Site Boundary lies within Flood Zones 1, 2 and 3, defined in accordance with the Flood Risk and Coastal Change Planning Policy Guidance (PPG).
- 4.19.3 The EA Flood Map for Planning indicates that the DCO Site Boundary predominantly lies in Flood Zone 1, however, the DCO Site Boundary crosses six main rivers which have associated Flood Zone 2 (medium risk of flooding from fluvial or tidal sources) and Flood Zone 3 (high risk of flooding from fluvial or tidal sources) extents.

- 4.19.4 The proposed Immingham Facility and Theddlethorpe Facility (Options 1 and 2) lie predominantly within Flood Zone 3 and are considered to be at high risk of flooding from tidal sources.
- 4.19.5 As such a Flood Risk Assessment has been produced (*ES Volume IV Appendix 11.5 (Application Document 6.4.11.5)*) which is proportionate to the nature and scale of the Proposed Development, which determines existing flood risk within and arising from the DCO Site Boundary, and, where required, recommends mitigation measures so the Viking CCS Pipeline remains safe over its lifetime. The mitigation measures recommended in the FRA are captured within the Draft Construction Environmental Management Plan (CEMP) (*ES Volume IV Appendix 3.1 (Application Document 6.4.3.1)*).

Methodology

- 4.19.6 The NPPF requires the effects of all forms of flood risk, both to and from the Proposed Development, are considered within this FRA. This includes:
- *Tidal flooding* – occur during extreme high tide and/or storm surge events, or the unlikely event of a breaching or overtopping scenario of existing tidal defences;
 - *Fluvial flooding* – occurs when the capacity of a river is exceeded. This can occur in response to high flows;
 - *Groundwater flooding* – occurs when groundwater levels exceed ground surface levels generally as a result of periods of sustained high rainfall;
 - *Surface water flooding* – occurs when rainfall is unable to drain away quickly in response to rainfall;
 - *Artificial Waterbodies* – including raised channels such as canals or storage features such as ponds and reservoirs; and
 - *Drainage and Sewage Infrastructure* – insufficient or reduced drainage capacity within the sewer network can result in drainage capacity being exceeded causing extensive surface water flooding.
- 4.19.7 Future impacts from climate change on new developments should be considered within an FRA in regard to. The EA published updated climate change allowances in May 2022 to support the NPPF, which supersede all previous allowances written in the Flood Risk & Coastal Change PPG. These are detailed in Section 4.2 of the *FRA (ES Appendix 11.5 (Application Document 6.4.11.5))*.

Assessment of Flood Risk

Tidal Flood Risk

- 4.19.8 Tidal flood risk applies to Section 1 and 5 of the DCO Site Boundary, and so mitigation measures are recommended including appropriate construction management practices and adoption of an appropriate Flood Warning and Evacuation Plan (FWEP).
- 4.19.9 During the operation phase, the Immingham and Theddlethorpe Facilities will be at a residual risk of tidal flooding from a breach of defences. However, these facilities will not remain operational should a breach in defences occur, as the facilities which feed CO₂ into the pipeline would shut down during a flood event.
- 4.19.10 To ensure the Immingham and Theddlethorpe Facilities are resilient to flooding and can be brought back online as quickly as possible, the following mitigation measures are recommended, in line with advice from the Environment Agency:
- Critical electrical equipment should be raised a minimum of 300mm above the 2100 0.1% AEP breach level. This would be no higher than the extreme sea level for 2100.

This could be achieved by raising infrastructure on a table or if this is not possible then vulnerable infrastructure should be located within a watertight surround;

- A Flood Warning and Evacuation Plan should be provided;
- Use of flood resistant and resilient construction materials;
- Facility users to sign up to the EA Flood Warning Service to receive flood warnings; and
- No maintenance visits during periods when a Flood Warning is in force.

Fluvial Flood Risk

4.19.11 Sections 2, 3 and 4 of the DCO Site Boundary are predominantly at risk of flooding from fluvial sources, while the watercourse crossings in Sections 1 and 5 are also at risk of flooding from fluvial sources.

4.19.12 All main river crossings will be undertaken using trenchless techniques, while smaller, ordinary watercourse crossings are likely to be made using open cut techniques.

4.19.13 During the construction phase the Immingham Facility is at risk of flooding from the South Killingholme Drain. This drain will be diverted in association with the Humber Zero project. To mitigate the impact of the construction phase on watercourses that will be crossed by the pipeline throughout the DCO Site Boundary, the following mitigation measures are recommended:

- Water will not be pumped into a watercourse, be allowed to directly enter a watercourse, or be discharged to ground;
- Flume pipes will be sized to reflect the span width and the estimated flow characteristics of the watercourse under peak flow conditions; and
- During the installation of the auger bore crossings, a Hydrological Impact Appraisal will be undertaken for each drilling pit prior to works taking place to ensure that there are no impacts on flows within adjacent watercourses.

4.19.14 To mitigate the impacts of the construction phase on the crossings with flood defences, in Sections 3, 4 and 5 of the DCO Site Boundary, the following mitigation measures are recommended:

- The integrity of the flood defences will be maintained by only using trenchless techniques for main rivers crossings and installing any temporary crossings for Ordinary Watercourses bank top to bank top; and
- Access will be maintained to allow the EA/IDB/LLFA to continue defence maintenance activities.

4.19.15 To mitigate the risk of impacting flows and displacing floodwater during the construction phase, the following mitigation measures are recommended:

- Works within the easement of IDB drains and ordinary watercourses will require consent from the North East Lindsey IDB/LLFA;
- Construction works should not be undertaken during periods of heavy rainfall;
- Weather forecasts and Flood Warnings should be monitored regularly during the construction phase;
- Minimal storage of materials/plant in the floodplain; and
- A surface water drainage system to intercept and attenuate all runoff generated (refer to the Drainage Strategy in *ES Volume IV Appendix 11.3 (Application Document 6.4.11.3)*).

4.19.16 During the operation phase the pipeline would be below ground across its entire route, therefore the risk of fluvial flooding to this aspect of the development and from the development to surrounding areas is considered to be low and no mitigation is required.

4.19.17 The Block Valve Stations in Sections 2, 3 and 4 of the DCO Site Boundary lie in Flood Zone 1 and are therefore not considered to be at risk of flooding from fluvial sources.

Groundwater Flood Risk

4.19.18 During the construction phase, appropriate construction practices will need to be adhered to in order to manage the risk of groundwater ingress into excavations during construction, such as dewatering and pumping techniques, as required.

4.19.19 The pipeline route would be below ground across its entire route and therefore has the potential to encroach within the groundwater table. The pipeline will need to be designed appropriately to take into account hydrostatic pressure and the floatation risk to the pipeline from elevated groundwater.

4.19.20 As a precautionary measure, any below ground elements associated with the DCO Site Boundary should be designed in such a way as to withstand any upward hydraulic pressures in the event that groundwater levels rise as a result of climate change.

4.19.21 Given the scale and nature of the construction works and pipeline relative to the surrounding groundwater catchment, the ability of the construction phase to impact sub-surface flow regimes or groundwater storage capabilities is considered to be low and no mitigation is required.

Surface Water Flood Risk

4.19.22 The DCO Site Boundary are considered to be at low risk of flooding from surface water.

4.19.23 Block Valve Station 2 is at high risk of flooding from surface water. The EA RoFSW maps indicate localised ponding from a local land drain during higher return period events, with depths of up to 300mm. The valve actuator will extend above ground to a level above the 1% AEP plus climate change pluvial flood level.

4.19.24 During the construction phase of the pipeline, Immingham and Theddlethorpe Facilities and Block Valve Stations, appropriate construction practices will need to be adhered to in order to manage the risk of surface water ingress into excavations during construction, such as temporary drainage provisions and pumping as required.

4.19.25 The pipeline would be below ground across its entire route during the operational phase, therefore the risk of surface water flooding to this aspect of the development is considered to be low and no mitigation is required.

4.19.26 A surface water drainage system to intercept and attenuate all runoff generated (refer to the Drainage Strategy in *ES Volume IV Appendix 11.3 (Application Document 6.4.11.3)*) will mitigate impacts from the development to elsewhere during both the construction and operation phases.

Artificial Waterbodies

4.19.27 The Proposed Development is not considered to be at risk of flooding from artificial sources.

Drainage and Sewerage Infrastructure

4.19.28 A desktop study undertaken by GroundSure identifies that there is no known drainage and sewerage infrastructure present below the DCO Site Boundary, therefore the Proposed Development is not considered to be at risk from drainage and sewerage infrastructure sources.

Summary

4.19.29 The FRA has demonstrated that it will be possible to manage flood risks to and from the Proposed Development in compliance with the NPPF and accompanying Planning Practice Guidance.

4.19.30 For more detailed information refer to *ES Volume IV Appendix 11.5 FRA (Application Document 6.4.11.5)*.

5 Viking CCS Development Project

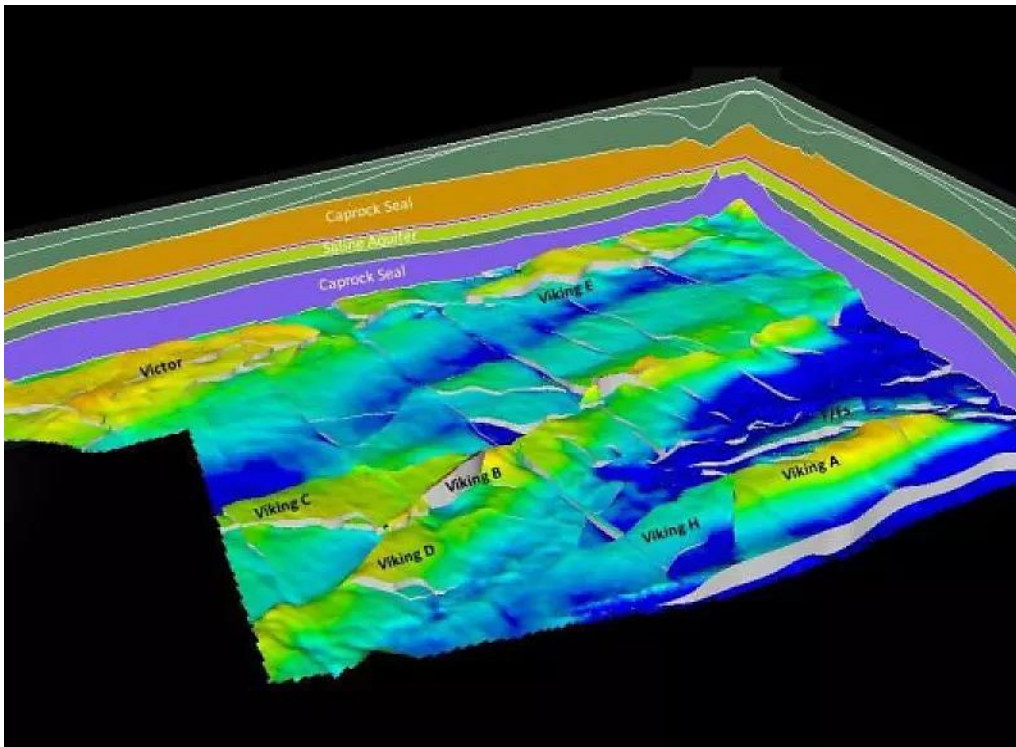
5.1 Overview

- 5.1.1 The Viking CCS Development Project will include the following construction activities:
- Repurposing of the existing 118 km long, 36” diameter offshore LOGGS pipeline;
 - Installation of a new 28km long, 36” diameter offshore pipeline spur;
 - Installation of a new offshore not permanently attended installation (NPAI) at the Victor Field;
 - Drilling of CO₂ injector wells.
- 5.1.2 Once operational, the pipelines, subsea isolation valve (SSIV), wells and NPAI will be maintained and the storage reservoir will be continually monitored and managed.

Storage

- 5.1.3 The Viking reservoirs are located approximately 140 km offshore in the Southern North Sea (SNS) and 2.7km beneath the seabed. The depth of storage, combined with a regional “Superseal” caprock, makes the reservoirs secure for storing captured CO₂. The caprock is made up primarily of layers of salt, hundreds of feet thick, which acts as a high-strength barrier through which the CO₂ cannot pass. This caprock gives Harbour a high confidence in the ability of the storage site to keep CO₂ in place (**Figure 5-1**).
- 5.1.4 Furthermore, a secondary permeable formation above the primary storage site, known as the Bunter Sandstone, has the capability to act as secondary containment which adds to the security of the site.
- 5.1.5 The North Sea Transition Authority (NSTA) regulates offshore carbon dioxide storage and is the licensing authority. The NSTA approve and issue storage permits – and maintains the carbon storage public register. The Applicant has been granted a licence for licence area Carbon Storage (CS) 005.
- 5.1.6 Of the reservoirs in the CS005 licence area, eight discrete units have been identified for carbon storage. The first to be utilised as a CCS site is the Victor field reservoir. It is anticipated that once the first reservoir has been filled and sealed, Harbour Energy will move on to the Viking reservoirs. The 8 identified stores in the CS005 licence have over 300 million tonnes of initial storage capacity, allowing the reservoirs to meet the contemporary and future demand for CCS.

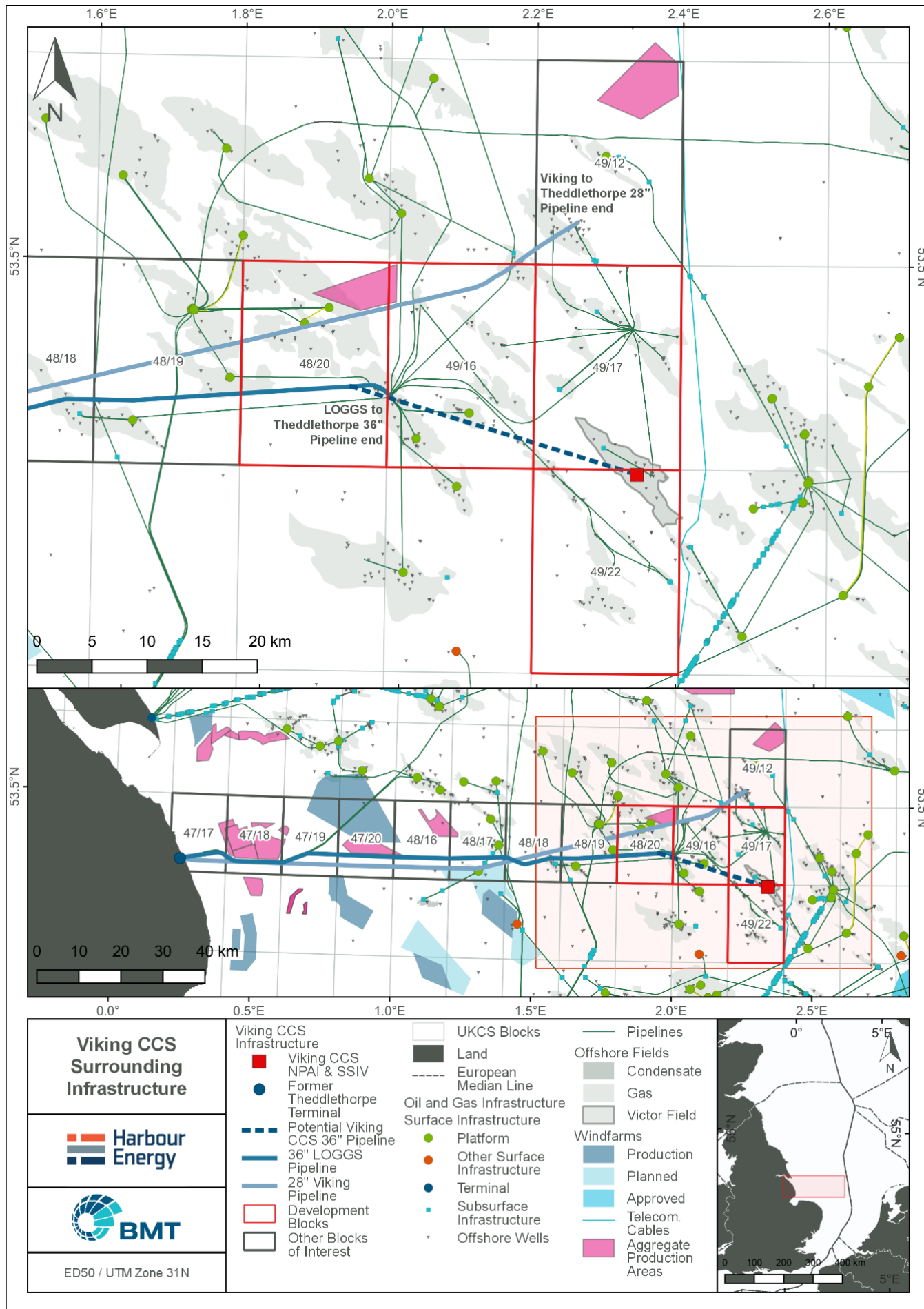
Figure 5-1: Viking Area Reservoir Layout



5.2 Offshore Infrastructure

- 5.2.1 The conditioned, dehydrated and compressed CO₂ will be transported from the onshore Theddlethorpe Facility, offshore via the existing 118 km long, 36" diameter LOGGS pipeline, with a new 28 km long, 36" diameter offshore pipeline spur to connect to the new NPAI.
- 5.2.2 The LOGGS pipeline was first operated in 1988, transporting collected natural gas from a variety of gas fields (including the Viking and Victor fields) in the SNS to shore. The pipeline ceased operations in 2018, and in line with regulations, it was flushed clean of hydrocarbons. The 36" diameter LOGGS pipeline to the new onshore pipeline which will connect in to the Theddlethorpe Facility, are shown in **Figure 5-2**.
- 5.2.3 Several studies have been undertaken on the existing LOGGS pipeline including a fracture assessment, integrity assessment, life extension and repurposing assessments, which have resulted in high confidence that the existing LOGGS pipeline will be suitable for the transportation of the CO₂ as part of the Viking CCS development.
- 5.2.4 The majority of the new offshore pipeline will be laid in a trench and naturally backfilled. Crossings over existing pipelines will be surface laid over the crossed pipeline, protected by concrete mattresses and rock. The new 36" diameter offshore pipeline section will include a SSIV located at the Victor field, which will connect to the NPAI via new tie-in spools. The current design concept also assumes a connection to the Tampnet network via a fibre optic cable which runs close to the proposed Victor injection site (**Figure 5-2**).
- 5.2.5 The NPAI will be a 4-legged steel jacket hosting injection facilities and surface trees.

Figure 5-2: Offshore Location of the Viking CCS Development Project



5.3 Wells

- 5.3.1 It is anticipated that the initial storage site at Victor will have four to six injection wells. The wells will be of a surface design and so will have dry trees and wellheads located on an unmanned installation. The phasing of these wells is still to be decided but they will be drilled from a jack-up drilling rig due to the shallow water depth. The wells will follow a standard SNS well design as per historic SNS gas production wells in the area. All wells will be designed, drilled and operated as per Harbour Energy's internal well design and operations standards and aligned with industry best practice. The well campaign will also see an increase in associated marine activity to support the operational activities during drilling.
- 5.3.2 The drilling fluids to be used are still to be determined but will most likely consist of a mix of water-based fluids for surface holes and oil-based or synthetic fluids for the deeper sections. The water-based drilling fluid will be discharged at seabed under the associated drilling permit. These fluids will consist mainly of bentonite and barite, both of which are deemed by OSPAR List of Substances Used and Discharged Offshore, 2019 to pose little or no risk to the environment.
- 5.3.3 The oil-based or synthetic fluids required for the deeper sections are needed due to the depleted nature of the reservoir and inhibition required to drill through the thick Zechstein section. These oil-based or synthetic fluids would be recovered to the rig and any associated cuttings would be contained on the rig before transport onshore for processing and disposal.

5.4 Operational Phase

- 5.4.1 The operational phase of the Offshore Project will give rise to activities which will interact with the immediate marine environment including power generation on the NPAI, inspection, maintenance and repair operations and storage measurement, monitoring & verification activities (atmospheric emissions, underwater noise via seismic surveys).

5.5 Schedule

- 5.5.1 The Viking CCS Cluster's final investment decision is planned from 2024, with construction commencing late 2024 and first storage from as early as 2027.

5.6 Environmental Impact Assessment

- 5.6.1 The Offshore Project is currently in the process of scoping their EIA and have produced an EIA Scoping Report to consult on with relevant consultees. The activities associated with the Offshore Project were reviewed against the baseline physical, biological and socioeconomic environment developed during the EIA Scoping process. The following environmental and societal issues and impacts were categorised as to whether they could result in a significant residual impact taking into account known and potential controls and mitigation measures:

- Energy Use and Atmospheric Emissions;
- Seabed Disturbance;
- Underwater Noise;
- Socio-economics;
- Discharges to Sea;
- Waste; and
- Accidental Events.

5.6.2 **Table 3** summaries the outcome from this review of the activity, potential impacts, controls and mitigation measures, and whether the aspect can be scoped-out or scoped-in of the EIA process.

Table 3: Summary of Potential Impacts and Scope of the Offshore Project EIA

ES Section	Activity and/or Events	Potential Impact(s)	Proposed Controls/ Mitigation Measures	Scoped-In/ Scoped-Out of EIA
Energy Use and Atmospheric Emissions	<ul style="list-style-type: none"> Well drilling with MODU, support vessels and helicopter use. Construction activities, including vessel operations. Emissions from power generation on the platform. 	<ul style="list-style-type: none"> Deterioration of local air quality. Contribution of GHGs. Generation of acid rain from oxides of nitrogen (NO_x) and sulphur (SO_x). 	<ul style="list-style-type: none"> All generators and engines will be maintained and operated to the manufacturers' standards to ensure maximum efficiency. Vessels will use ultra-low sulphur fuel in line with MARPOL requirements. Work programmes will be planned to optimise vessel time in the field. Fuel consumption will be minimised by operational practices and power management systems for engines, generators and other combustion plant and maintenance systems. All mitigation measures will be incorporated into contractual documents of subcontractors. Vessel fuel usage and emissions will be recorded. Machinery and equipment will be in good working order and well-maintained. The number of vessels utilising dynamic positioning will be minimised. 	Scoped In
	<ul style="list-style-type: none"> CO₂ venting during maintenance. 	<ul style="list-style-type: none"> Contribution of GHGs. 	<ul style="list-style-type: none"> Frequency and duration of CO₂ venting during maintenance activities (pigging activities or any breaking of containment scopes) will be minimised. 	Scoped In
Seabed Disturbance	<ul style="list-style-type: none"> Pipeline, SSIV and platform installation. Anchoring (if needed, anchoring not anticipated at this time). Placement of rock and/ or 	<ul style="list-style-type: none"> Direct loss of benthic species. Direct loss of existing seabed habitat. Wider indirect disturbance to the benthic environment through the suspension and re-settlement of sediments. 	<ul style="list-style-type: none"> Pipelaying and subsea installation operations will be monitored by a remotely operated vehicle (ROV) to ensure accurate placement of equipment and minimise any impact on seabed sediment. Environmental baseline and habitat surveys of pipeline route and location for platform. All anchors will be completely removed from the seabed at the end of the operations. An overtrawl survey will be undertaken following installation activities and establish whether any additional mitigation is needed. 	Scoped In

ES Section	Activity and/or Events	Potential Impact(s)	Proposed Controls/ Mitigation Measures	Scoped-In/ Scoped-Out of EIA
	concrete mattresses.	<ul style="list-style-type: none"> The installation of the subsea infrastructures will disturb benthic habitats and communities. Placement of rock and protective materials will disturb seabed communities, pose obstruction to demersal trawling and lead to loss of natural habitat. Spudding of the jack-up rig and the wire anchors will leave scars on the seabed and will disturb the benthic communities. 	<ul style="list-style-type: none"> A rock-placement vessel or construction support vessel with ROV will be used for any rock placement (if required). The rock mass will be carefully placed by ROV and/ or controlled fall pipe equipped with cameras, profilers, pipe tracker and other sensors as required. This will enable accurate placement of rock within the planned footprint with minimal spread over adjacent sediment, minimising loss of habitat and seabed disturbance. Any protective and stabilisation material placed on or adjacent to the seabed will allow fishing nets to overtrawl unobstructed. If rock is required, suitably graded rock will be used to minimise the risk of snagging fishing gear. Placement of rock will be minimised wherever possible. 	
Underwater Noise	<ul style="list-style-type: none"> Noise from drilling and vessels. Noise from pipelay and vessels. Noise from piling. 	<ul style="list-style-type: none"> Injury and disturbance to marine mammals and fish through noise from drilling, piling and vessel transport during the project. 	<ul style="list-style-type: none"> Duration of activities will be limited. If piling, a Marine Mammal Observer will be on board during operations, with piling only commencing in the absence of marine mammals, following JNCC guidelines. A soft-start will be utilised. 	Scoped In
Socio-economic Impacts	Physical presence of installation vessels, MODU	<ul style="list-style-type: none"> Interference with shipping and fishing activities that may occur in the area. 	<ul style="list-style-type: none"> Prior to commencement of operations, the appropriate notifications will be made and maritime notices posted. All vessel activities will be in accordance with national and international regulations. 	Scoped In

ES Section	Activity and/or Events	Potential Impact(s)	Proposed Controls/ Mitigation Measures	Scoped-In/ Scoped-Out of EIA
	<ul style="list-style-type: none"> and support vessels. Potential interference to other users of the sea. 	<ul style="list-style-type: none"> Loss of access to the area for other vessels on a temporary or permanent basis. Increased risk of vessel collisions through the presence of the drill rig and other vessels during the proposed activities. 	<ul style="list-style-type: none"> Placement of 500 m safety/ exclusion zones around drill centres. Appropriate navigation aids will be used in accordance with the consent to locate conditions to ensure other users of the sea are made aware of the presence of vessels. The number of vessels travelling to or standing by will be kept to a minimum. 	
	<ul style="list-style-type: none"> Presence of subsea obstructions, subsea infrastructure and pipeline. 	<ul style="list-style-type: none"> Potential snagging risks. Damage to or loss of fishing gear. 	<ul style="list-style-type: none"> On-going consultation with fisheries representatives. Post-installation seabed clearance. Subsea structures will be fishing friendly. Subsea structures and pipeline will be mapped and the UK Hydrographic Office (UKHO) and Kingfisher informed. 	Scoped In
	<ul style="list-style-type: none"> Onshore disposal of drill cuttings. 	<ul style="list-style-type: none"> Use of landfill disposal facilities. Contamination of land and water. Treatment of low toxicity oil based mud (LTOBM) cuttings may contribute to the deterioration of air quality. 	<ul style="list-style-type: none"> Only use of licensed contractors at licensed sites. 	Scoped In
Discharges to Sea	<ul style="list-style-type: none"> Drill cuttings, fluids and cement; inspection and 	<ul style="list-style-type: none"> Discharge of water based mud (WBM) cuttings and completion chemicals 	<ul style="list-style-type: none"> Any WBM will be discharged to sea under permit approval. Cement usage and discharge will be minimised and handled/ disposed of in accordance with current legislation. 	Scoped In

ES Section	Activity and/or Events	Potential Impact(s)	Proposed Controls/ Mitigation Measures	Scoped-In/ Scoped-Out of EIA
	<p>hydrostatic testing of pipelines.</p>	<p>from drilling operations onto the seabed and into the water column, resulting in changes in water quality, localised and temporarily increased suspended solid concentrations, and possible impacts to organisms in the water column and on the seabed.</p> <ul style="list-style-type: none"> Discharge of waters from pipeline resulting in changes in water quality. 	<ul style="list-style-type: none"> Modelling will support planning for pipeline inspection. Chemical permits for chemicals released into the marine environment. 	
	<ul style="list-style-type: none"> Discharges during installation activities from vessels, i.e., blackwater production (sewage), grey water (from showers, laundry, hand and eye wash basins and drinking fountains), and food waste 	<ul style="list-style-type: none"> Impact to water quality. Impact to fish and shellfish. 	<ul style="list-style-type: none"> Ensure that minimum requirement for screening and discharge in line with MARPOL Annex IV. Temporary storage available on board. 	<p>Scoped Out: Localised, transient impact around discharge point; Discharged material disperses, degrades naturally</p>

ES Section	Activity and/or Events	Potential Impact(s)	Proposed Controls/ Mitigation Measures	Scoped-In/ Scoped-Out of EIA
	(macerated) disposal			
	<ul style="list-style-type: none"> Discharge of ballast waters. 	<ul style="list-style-type: none"> Introduction of non-native species. 	<ul style="list-style-type: none"> Vessels abide by International Maritime Organization (IMO) guidance on ballasting. Approved ballast water management plan. No major international movement of vessels expected for this project Marine assurance auditing by Harbour. 	Scoped Out Low risk of transfer
Waste	<ul style="list-style-type: none"> Generation and disposal of non-hazardous and hazardous waste streams. Onshore disposal of solid waste. 	<ul style="list-style-type: none"> Potential impacts to the air quality, hydrology, flora and fauna, and socioeconomic aspects of such sites. 	<ul style="list-style-type: none"> Defined waste management plan and procedures. Licensed wastes facilities. Segregation and recycling of waste materials whenever possible. 	Scoped Out
Accidental events	<ul style="list-style-type: none"> Vessel collision. 	<ul style="list-style-type: none"> Accidental release of hydrocarbons. 	<ul style="list-style-type: none"> Local shipping traffic would be informed of proposed installation activities and a standby/ support vessel would monitor shipping traffic at all times. 	Scoped In
	<ul style="list-style-type: none"> Loss of CO₂ from pipelines or storage reservoir. 	<ul style="list-style-type: none"> Accidental release of CO₂. Contribution of GHGs. 	<ul style="list-style-type: none"> System design including inline block valves to minimise the pipeline inventory in an emergency event. To reduce risks associated with CO₂ leaks from pipelines, Harbour will deploy a management/safety plan that sets out monitoring, inspection, and operational requirements as well as 	Scoped In

ES Section	Activity and/or Events	Potential Impact(s)	Proposed Controls/ Mitigation Measures	Scoped-In/ Scoped-Out of EIA
			<p>emergency response procedures and specialist response support services.</p> <ul style="list-style-type: none"> • Pipeline monitoring will include internal inspection, external corrosion checks and leak detection. • Characterisation of the subsurface and associated risks in compliance with the Early Risk Assessment process and the Storage Permit application, as set out in the EU Directive. • Measurement, monitoring, and verification of the site pre, during and post-injection to ensure CO2 conformance and containment. 	
	<ul style="list-style-type: none"> • Chemical or fuel spill. 	<ul style="list-style-type: none"> • Impact to plankton and fish. 	<ul style="list-style-type: none"> • In the event of an accidental spill to sea, vessels will implement their Shipboard Oil Pollution Emergency Plan (SOPEP). • Management and operational controls to prevent this type of event in place. 	<p>Scoped Out: Quantities small and material disperses quickly</p>
	<ul style="list-style-type: none"> • Dropped objects. 	<ul style="list-style-type: none"> • Direct impact to benthic habitat and species. 	<ul style="list-style-type: none"> • Management controls for dropped objects. 	<p>Scoped Out: Impacted area small; Object recovered</p>

5.6.3 The environmental and social aspects which will be assessed further in the ES:

- Energy Use and Atmospheric Emissions;
- Seabed Disturbance;
- Underwater Noise;
- Discharges to Sea;
- Accidental Events; and
- Socio-economic impacts.

5.7 Habitat Regulations Assessment (HRA)

5.7.1 In the Habitats Regulations and Offshore Habitats Regulations, both inshore and offshore protected designated sites are housed within a national network that includes all SPAs and SACs. Although Ramsar sites do not form part of the national site network, many of the Ramsar sites in the UK overlap with SACs and SPAs, designated for the same species and habitats.

5.7.2 If a project is being carried out on a recognised SPA, SAC and/or Ramsar site, a Habitats Regulations Assessment (HRA) will be needed to assess the level of damage that could be caused to the area as a result of development proposals.

5.7.3 The overarching aim of the HRA is to determine, in view of a site's conservation objectives and qualifying interests, whether a project, either in isolation and / or in-combination with other plans or projects, could lead to adverse effects on the integrity of a site. If the Viking CCS project is likely to result in significant impacts on the conservation objectives and qualifying interests of a site, OPRED, as the competent authority, must make an appropriate assessment of the implications of the plan or project for that site.

5.7.4 Therefore, all the information required to support the HRA process will be presented within the ES to assist with an appropriate assessment.

6 Inter Project effects between the Proposed Development and the Viking CCS Offshore Development Project

6.1 Introduction

6.1.1 This Bridging Document has provided a summary of the potential impacts associated with both the Proposed Development and the Viking CCS Development Project. An additional step is to now seek to identify any likely inter project effects of the Viking CCS Project between the two sub-projects: the Proposed Development and the Viking CCS Development Project.

6.1.2 In this context, inter project effects are defined as those impacts which, when combined, have the potential to affect an individual or environmental or social receptor. The assessment of inter project effects is qualitative and based on professional judgement and the information available at the time of writing.

6.2 Baseline

6.2.1 There are five European designated sites located within 10 km of the Proposed Development. They include:

- Humber Estuary Special Protection Area (SPA) - within the DCO Site Boundary;
- Humber Estuary Special Area of Conservation (SAC) - 1.27 km east of the DCO Site Boundary;
- Humber Estuary Ramsar - within the DCO Site Boundary;
- Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC - within the DCO Site Boundary; and,
- Greater Wash SPA with marine components - within the DCO Site Boundary.

6.2.2 The intertidal zone near Theddlethorpe where the two sub-projects meet is designated as the Humber Estuary SAC, SPA and Ramsar site. The Humber Estuary SAC, SPA and Ramsar has many qualifying species including breeding and wintering birds, and habitats including dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons. The HRA (Application Document 6.5) explains in detail the qualifying features and sensitivity of each of these designated sites.

6.2.3 Further details on the baseline conditions are included within ES Volume II and ES Volume IV.

6.3 Potential Sources of Impacts and Pathways

6.3.1 The component of the Viking CCS Project within the intertidal zone, is the existing LOGGS pipeline. The LOGGS pipeline was first operated in 1988, transporting collected natural gas from a variety of gas fields (including the Viking field) in the North Sea to shore. The pipeline ceased operations in 2018, and in line with regulations, it was flushed clean of any hydrocarbons. Several assessments have been undertaken of the pipeline including a fracture assessment, integrity assessment and CO₂ corrosion assessment, which have resulted in high confidence that the pipeline will be suitable for the transportation of the CO₂ as part of the wider Viking CCS Project.

- 6.3.2 The existing LOGGS pipeline is to be repurposed requiring no construction or intrusive repair works along its existing 118 km. Therefore, there is no source of, or potential pathway of impact to the designated sites or marine environment. Therefore, inter project effects between the Proposed Development and the Viking CCS Development Project will not arise within the intertidal zone.
- 6.3.3 Additionally, the location of the newest infrastructure for the Viking CCS Development Project is more than 118 km offshore, which is located more than 119 km away from the nearest newest infrastructure associated with the Proposed Development (replacement of the Dune Valve Isolation). Consequently, the opportunity for any interaction or overlap of impacts during either construction or operation will not occur, as the distances between the various activities would be so substantial. Consequently, no inter project effects on the wider Viking CCS Project are expected to occur.

7 Conclusions

- 7.1.1 This Bridging Document sets out to summarise the main interfaces of the Viking CCS Pipeline and the Viking CCS Development Project and identify any likely inter project effects of the Viking CCS Project.
- 7.1.2 The Proposed Development and the EIA undertaken is summarised in section 3 and 4 of this report. The Viking CCS Development Project is summarised in section 5.
- 7.1.3 An inter-project effect assessment is presented in Section 6, which concludes there would be no source of effects for any inter project effects between the Proposed Development and the Viking CCS Development Project.

8 References

Ref 1 *HM Government (2008)*. Planning Act 2008. Available at:
<https://www.legislation.gov.uk/ukpga/2008/29/contents>

Ref 2 *HM Government (2017)*. Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. Available at:
<https://www.legislation.gov.uk/uksi/2017/572/contents/made>

Ref 3 *HM Government (2009)*. The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009. Available at:
<https://www.legislation.gov.uk/uksi/2009/2264/contents/made>

Ref 4 *Department of Energy and Climate Change (2011)*. Overarching National Policy Statement for Energy (EN-1). Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Ref 5 *Department of Energy and Climate Change (2011)*. National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47857/1941-nps-gas-supply-oil-en4.pdf

Ref 6 *Department for Energy Security & Net Zero (2023)*. Draft Overarching National Policy Statement for Energy (EN-1). Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147380/NPS_EN-1.pdf

Ref 7 *Department for Energy Security & Net Zero (2023)*. Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147383/NPS_EN-4.pdf

Ref 8 *Ministry of Housing, Communities & Local Government (2021)*. National Planning Policy Framework (NPPF). Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

Ref 9 *HM Government (2011)*. The Localism Act 2011. Available at:

<https://www.legislation.gov.uk/ukpga/2011/20/contents/enacted>

Ref 10 *Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2021)*. Planning Practice Guidance (PPG). Available at:

<https://www.gov.uk/government/collections/planning-practice-guidance>

Ref 11 *HM Government (2017)*. Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Available at:

<https://www.legislation.gov.uk/uksi/2017/407/contents/made>

Ref 12 *HM Government (2016)*. Environmental Permitting Regulations (England and Wales) 2016. Available at: <https://www.legislation.gov.uk/uksi/2016/1154/contents/made>.

Ref 13 *British Standards Institution (2015)*. PD8010 Code of Practice for Pipelines – Part 1 Steel Pipelines on Land.

Ref 14 *HM Government (1996)*. Pipeline Safety Regulations 1996. Available at:

<https://www.legislation.gov.uk/uksi/1996/825/contents/made>.

Ref 15 *HM Government (2009)*. Marine and Coastal Access Act (2009). Available at:

<https://www.legislation.gov.uk/ukpga/2009/23/contents>

Ref 16 *HM Government (2008)*. Energy Act (2008). Available at:

<https://www.legislation.gov.uk/ukpga/2008/32/contents>

Ref 17 *HM Government (2017)*. Conservation of Habitats and Species Regulations (2017). Available at: <https://www.legislation.gov.uk/uksi/2017/1012/contents/made>

Ref 18 *HM Government (2017)*. The Conservation of Offshore Marine Habitat Species Regulations (2017). Available at:

<https://www.legislation.gov.uk/uksi/2017/1013/contents/made>

Ref 19 *HM Government (2020)*. Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020. Available at:

<https://www.legislation.gov.uk/uksi/2020/1497/contents/made>

Ref 20 *Planning Inspectorate (2017)*. Advice Note Eighteen: The Water Framework Directive. Available at: <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-18/>

