Humber Zero Design and Access Statement

VPI Immingham LLP

Project number: 15862

February 2023

CONTENTS

TABLES

FIGURES

Revision	Description	Originated	Checked	Reviewed	Authorised	Date
0	For Final Client Sign off	CC	CT			

DWD Job Number: 15862

1.0 INTRODUCTION

1.1 Preamble

1.1.1 This Design and Access Statement has been prepared in support of an application for full planning permission submitted to North Lincolnshire Council (the 'Council') under the provisions of the Town and Country Planning Act 1990 (as amended) on behalf of VPI Immingham LLP (the 'Applicant').

1.2 Overview of the Proposed Development

1.2.1 The Proposed Development comprises a PCC Plant within the existing VPI Combined Heat and Power (CHP) Plant.

1.2.2 VPI Immingham's CHP Plant was constructed in two phases, and supplies:

- Heat (in the form of steam) to the two adjacent oil refineries (including Phillips 66 Limited's Humber Refinery); and
- Electrical power to the adjacent oil refinery and the National Grid Electricity Transmission System.

1.2.3 The first phase, commissioned in 2004, comprised the installation of two gas turbines (GT1 and GT2), each with associated heat recovery steam generators (HRSG1 and HRSG2) and steam turbines (ST1 and ST2). The first phase also comprised the installation of two auxiliary boilers (AB1 and AB2) to provide back-up heat (steam) supplies.

1.2.4 The second phase, commissioned in 2009, comprised the installation of an additional gas turbine (GT3), with an associated heat recovery steam generator (HRSG3) and steam turbine (ST3).

1.2.5 The Proposed PCC Plant will connect to two of the Gas Turbines (GTs) and the auxiliary boiler within the CHP plant.

1.2.6 The Proposed Development is associated with the Phillips 66 Limited Post-combustion Carbon Capture (PCC) Plant for the Humber Refinery as part of the 'Humber Zero' project. The latter is the subject of a separate planning application.

1.3 The Humber Zero Project

1.3.1 By 2050, the UK has committed to reducing carbon emissions to net zero. This can only be achieved by decarbonising existing industry effectively. Energy intensive industries account for more than 20% of the economy and 1 in 10 jobs in the Humber.

1.3.2 Humber Zero is a large-scale decarbonisation programme, being advanced in partnership by the Applicant and Phillips 66 Limited, that aims to remove up to 8 million tonnes (MT) of atmospheric CO2 emissions per annum from the Immingham industrial cluster by 2030 through the deployment of a number of technologies such as Carbon Capture, Utilisation and Storage (CCUS).

1.3.3 By 2028, the first phase of Humber Zero could remove up to 3.8 Mt of CO2 annually by capturing carbon from the Humber Refinery's FCC stack and two of the gas turbines and auxiliary boilers at the VPI Immingham CHP Plant.

1.3.4 Further information is available on the Humber Zero website, available at:

https://www.humberzero.co.uk/

1.3.5 The CO2 transportation network that the Proposed Development will connect into is also under development by others. There are two potential networks that the Proposed Development could be connected to: the proposed Viking CCS, formerly V Net Zero CO2 , transportation and storage network (promoted by Harbour Energy) which is anticipated to commence in the southern part of the VPI Site, or the East Coast Cluster Humber Low Carbon Pipelines (HLCP), also known as Zero Carbon Humber (promoted by National Grid Ventures). Both pipeline networks will run close to the Site and the decision as to which network will be connected in to initially will be made following Government funding announcements. It is likely that access to both transportation networks would be available in the long-term development of the networks. The association of Humber Zero with either V Net Zero or HLCP is limited to collaboration between both projects.

1.4 Environmental Impact Assessment

1.4.1 The 2017 Town and Country Planning (Environmental Impact Assessment) Regulations (as amended) (EIA Regulations) apply to applications for planning permission under the 1990 Town and Country Planning Act.

1.4.2 The Applicant submitted a request for an Environmental Impact Assessment ('EIA') Scoping Opinion, including a 'Humber Zero EIA Scoping Report' and 'Draft Technical Appendices', to the Council on 25th January 2022. The Council issued its Scoping Opinion on 11th March 2022 which confirmed that EIA is required for the Proposed Development and set out the range of matters to be addressed in the final production of the Environmental Statement.

1.4.3 Information pursuant to Regulation 18 of the EIA Regulations and as specified in Council's Scoping Opinion is provided in the enclosed Environmental Statement by AECOM Limited.

1.5 The Purpose and Structure of this Document

1.5.1 The DAS has been prepared to describe the approach that has been taken to the design of the Proposed Development and to demonstrate how regard has been had to the surrounding context and good design. The DAS describes the approach that has been taken to the design, how good design principles and concepts have been utilised and demonstrates how regard has been had to the surrounding context and to good design considerations. The DAS also explains how suitable access has been achieved to the proposed development and how specific access issues have been overcome.

Structure

1.5.2 The remainder of this document is structured as follows:

- Section 2 – Site and Surrounding Context
- Section 3 – Planning Policy Context
- Section 4 – Design Approach
- Section 5 – Design
- Section 6 – Access

- Section 7 – Summary and Conclusions

2.0 SITE AND SURROUNDING CONTEXT

2.1 Introduction

2.1.1 This section describes the location and key features of the Site and surrounding area, identifies any relevant planning and environmental designations, and explains the Applicant's site selection process.

2.2 Site Location, Description and Use

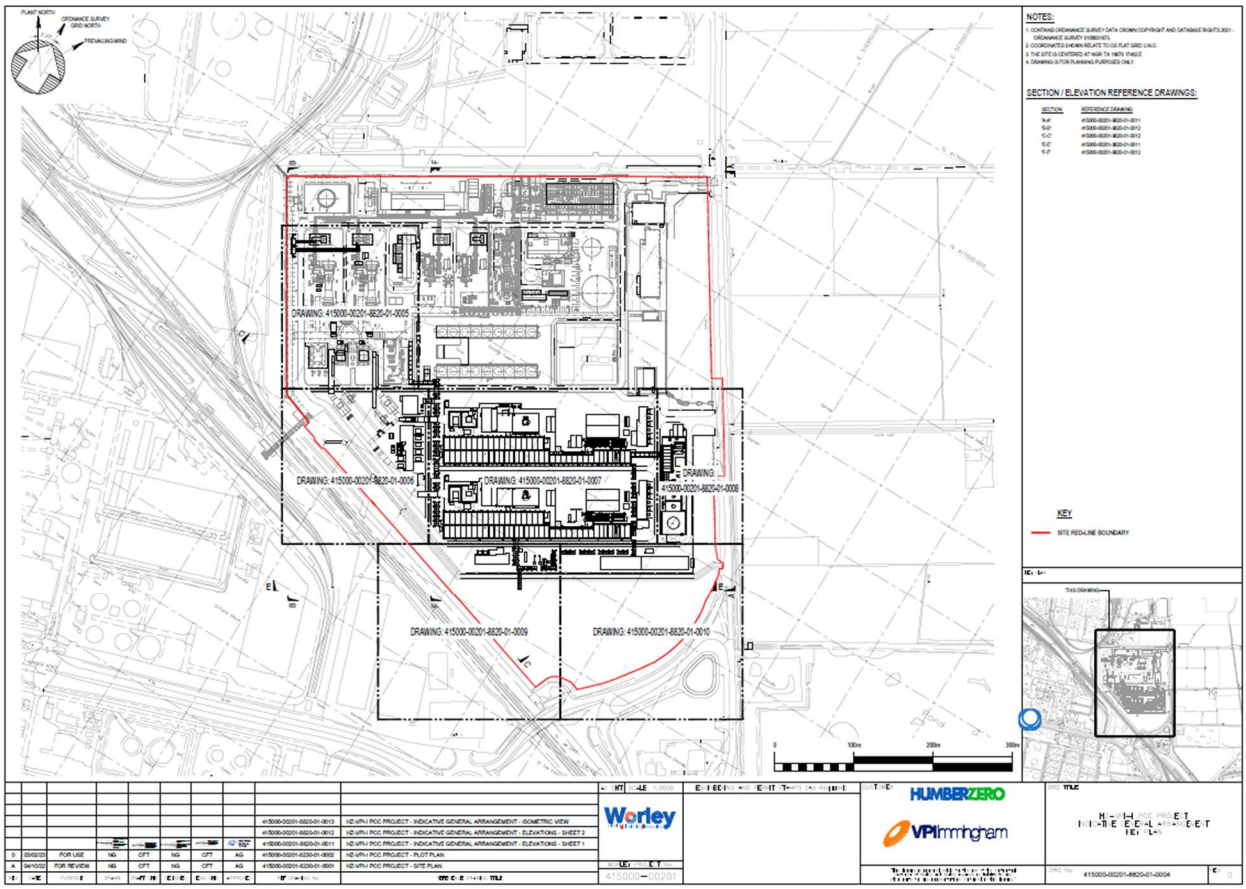
2.2.1 The Immingham industrial cluster is located on the south bank of the River Humber, approximately 1 kilometre from the coastline with the North Sea. The Proposed Development Site is located within the administrative area of North Lincolnshire Council, which is a unitary authority. The administrative boundary of North East Lincolnshire Council lies 1km to the south. The Site location is depicted in Figure 2.1 below.

Figure 2.1: Site Location

2.2.2 The Proposed Development Site is immediately to the south of the operational VPI Immingham CHP Plant, accessed from Rosper Road. The Site comprises grassland with an open ditch running west-east through the centre, areas of hardstanding and existing below ground utilities. The northern part of the VPI PCC plant area was previously used for laydown during the construction of the existing VPI Immingham CHP Power Station. The southernmost part of the VPI Site will not be developed but it will be used for construction laydown for the Proposed Development.

2.2.3 The existing CHP Plant is included in the VPI Site to allow for pipeline and cable connections between the CHP Plant and the Proposed Development. Available areas of the CHP Plant will also be used for construction laydown, and some of the existing CHP Plant facilities may be shared with the Proposed Development. Indicative locations for the PCC Plant within the VPI Combined Heat and Power (CHP) Plant for two of the Gas Turbines (GTs) and the auxiliary boiler are shown in Figure 2.2 below.

Figure 2.2: Proposed General Arrangement



2.2.4 The Lindsey Oil Refinery is immediately north west and Humber Refinery is immediately south west and is bisected from the Site by a railway line. Immingham Dock is approximately 1.5km to the south east of the CHP Plant at its closest point. The Humber port is located approximately 980m north at its closest point. The nearest settlement is the town of Immingham is located approximately 2.5km south of the Site and the nearest residential property is a single property on Marsh Lane located approximately 700m to the east.

2.2.5 The land to the north includes the site of the proposed VPI Immingham Open Cycle Gas Turbine ('OCGT') Power Station (also known as VPI Energy Park 'B'), which was granted development consent on 7 August 2020. In 2018 planning permission was granted on land to the north of and within the VPI Immingham CHP Plant (Council application reference. PA/2018/918) for the construction of a gas fired power station with a gross electrical output of up to 49.9 megawatts (known as VPI Immingham Energy Park 'A'). A railway line to the immediate west of the Site is a

spur servicing the Lindsey Oil Refinery and joins the main line approximately 400m south west of the Site. This line is the principal railway line in North East Lincolnshire and runs between Cleethorpes and Barton upon Humber.

2.2.6 The surrounding area comprises industrial and agricultural uses. Further eastwards beyond the railway line are agricultural fields (identified for development) approximately 1km toward the Humber Estuary. However, a large portion of these agricultural fields (approx. 100.3 ha) has been identified for future development of the Able Marine Energy Park ('AMEP') which was granted under Development Consent Order in December 2013. The scale of the project is substantial in comparison to the Proposed Development with the AMEP site covering an area of 268 ha on the southern bank of the Humber Estuary and structure/building heights up to 45m. The AMEP will be developed for a new quay and industrial uses, and will primarily serve the emerging renewable marine energy sector. This demonstrates the context of industrial activity and decarbonisation related development in the vicinity.

2.2.7 There is further large scale planned industrial and energy related development within 5km of the Site, particularly along the South Humber coast reinforcing the industrial character of the site and surrounding area. Further details are provided in the Environmental Statement, chapter 18 'Cumulative and Combined Effects'.

2.3 Site History

2.3.1 The Site has been subject to various forms of industrial development. The construction of the existing CHP Plant was approved under three separate consents between 1999 and 2001 before receiving planning permission to extend the CHP plant on 23rd March 2006 (Planning Ref. PA/2005/1884). The Proposed Development will connect to the existing CHP Plant.

2.3.2 More recently, North Lincolnshire Council granted VPI Immingham LLP with planning permission to construct and operate a temporary pilot post-combustion carbon capture plant and associated infrastructure (Planning Ref. PA/2022/1548). If deployed, the pilot plant will be constructed, operated and decommissioned prior to starting up the PCC plant.

2.3.3 Notably, North Lincolnshire Council issued an EIA scoping opinion for the V Net Zero (now Viking CSS) pipeline on 27th April 2022 (Planning Ref. PA/SCO/2022/5). Viking is one of two options being considered as the apparatus to which the Proposed Development would eventually connect.

2.4 Site Appraisal

2.4.1 It is clear the immediate context and surrounding area is characterised by large scale industrial development including large structures associated with power generation. That said, this is interspersed with agricultural land and small settlements to the west and east which is gradually changing, and will continue to change, as a result of planned development. As a result the site does not sit within a setting or landscape that is sensitive to change.

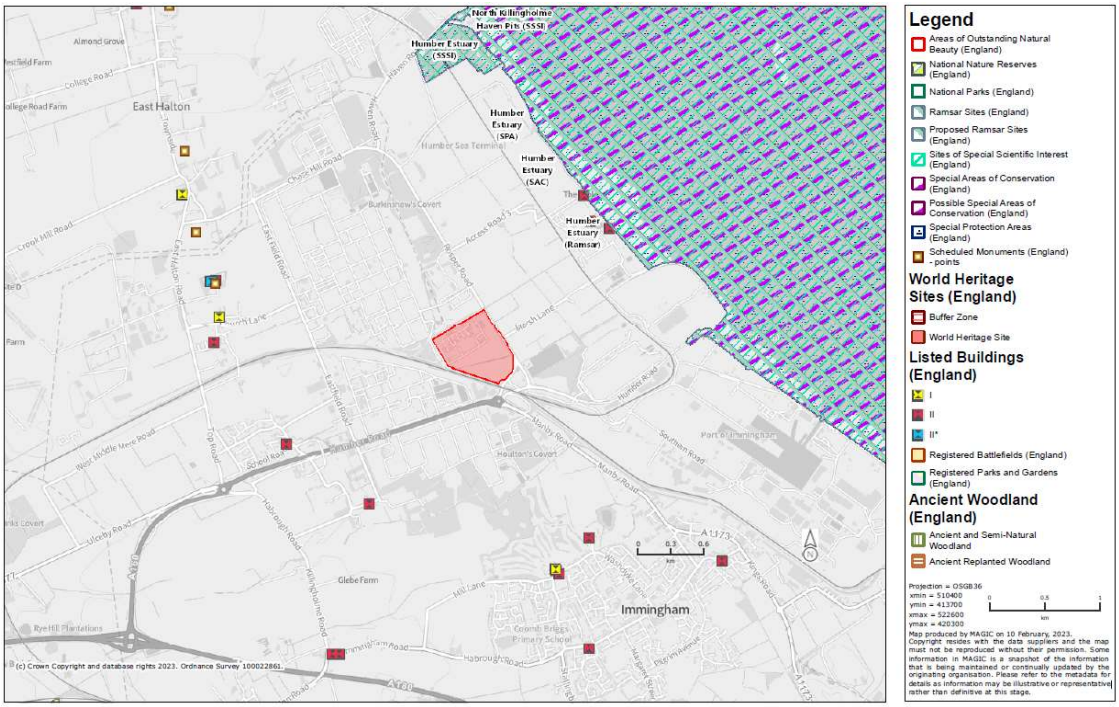
2.4.2 Taking account of the above, the Site presents a number of potential opportunities for the Proposed Development:

- The site is located within and adjoining the operational boundary of the existing Humber Refinery;
- the Site is surrounded by existing infrastructure and man-made landforms;
- Good highway links and some existing suitable accesses;
- Short connections to existing emission sources; and
- The Site and wider area are of relatively low environmental sensitivity.

2.5 Environmental Designations

2.5.1 A search of the Government's MAGIC Map database revealed that the site does not contain any environmental or heritage designations. An extract of the MAGIC Map search is provided as Figure 2.2.

Figure 2.2: MAGIC Map extract – Environmental and Heritage Designations

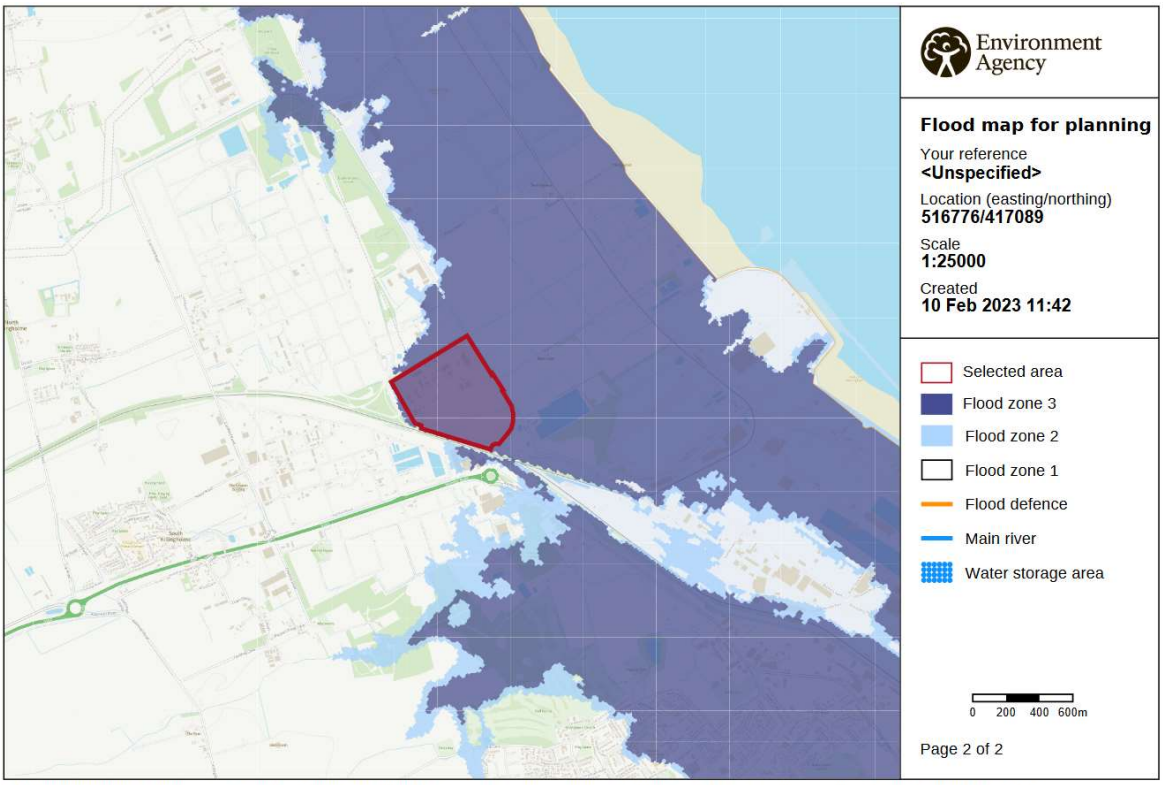


2.5.2 The closest environmental designation is the Humber Estuary which is designated as a Site of Special Scientific Interest ('SSSI'), a Special Protection Area ('SPA'), a Special Area of Conservation ('SAC') and Ramsar site, lying 1.6km to the north-east.

2.5.3 No heritage designations have been identified within the Site. The nearest listed buildings are three Grade 2 light houses 1.8km to the east and the Nook a Grade 2 listed building in South Killingholme, 1.6km to the west. Manor Farm Moated Site (NHLE 1008044) Scheduled Monument is approximately 2.1 km to the north-west.

2.5.4 A search of Environment Agency mapping shows the Site is located within Flood Zone 3 as illustrated in Figure 2.3. The red line showing in this figure is a sketch of the true application boundary

Figure 2.3: Flood Mapping



3.0 PLANNING POLICY CONTEXT

3.1 Introduction

3.1.1 This section summarises the design related legislative context and policy framework in respect of NSIPs, with particular emphasis on the relevant National Policy Statements. The planning application will be determined in accordance with section 70(2) of the Town and Country Planning Act 1990 (as amended), which states that in dealing with applications, local planning authorities shall have regard to the provisions of the statutory development plan and to other material considerations. Planning policy more generally is considered within the Planning Statement.

3.2 Legislative Context

3.2.1 The Town and Country Planning (Development Management Procedure) (England) Order 2015, Article 9 'Design and access statements' paragraph 3 states that a DAS must:

- Explain the design principles and concepts that have been applied to the development;
- Demonstrate the steps taken to appraise the context of the development and how the design of the development takes this context into account;
- Explain the policy adopted as to access, and how policies relating to access in relevant local development documents have been taken into account;
- State what, if any, consultation has been undertaken on issues relating to the access and design of the development and what account has been taken of the outcome of any such consultation; and
- Explain how any specific issues which might affect access to the development have been addressed.

3.3 Local Planning Policy

Core Strategy (2011)

3.3.1 Spatial Objective 10 of the Core Strategy 'Creating a Quality Environment' sets out NLC's ambition to ensure that all new development exhibits a high standard of design and architectural quality that respects distinctive landscapes and townscapes of North Lincolnshire.

3.3.2 The most relevant Core Strategy policy to the Proposed Development for the purposes of this DAS is Policy CS5 'Delivering Quality Design in North Lincolnshire'. CS5 makes clear that all new development in North Lincolnshire should be well designed and appropriate for their context; encouraging contemporary design provided it is appropriate for its location and is informed by its surrounding context in particular terms of scale, density, layout and access. The policy also notes that developments should incorporate principles of sustainable development in their design; consider their function and appropriateness in the context of their located; be easily accessible to all users and incorporate appropriate landscaping and planting which enhances biodiversity.

Policies from the Allocations DPD (2016)

3.3.3 Although the Allocations DPD forms part of the Development Plan for the area, none of its policies are considered to be of relevance to the Proposed Development.

Saved Policies of the Local Plan (2003)

3.3.4 The following saved policies are considered relevant:

- DS1 – General Requirements;
- RD2 – Development in the Open Countryside;
- T1 – Location of Development
- T2 – Access to Development
- T19 – Car Parking Provision and Standards.

3.4 National Planning Policy

National planning Policy Framework

3.4.1 Chapter 12 of the NPPF contains national planning policies in relation to design, applicable to all types of development including residential proposals and employment development.

3.4.2 Paragraph 126 explains that the creation of high quality, beautiful and sustainable buildings and places is fundamental to what the planning and development process should achieve. Good design is a key aspect of sustainable development.

3.4.3 Paragraph 130 seeks that developments function well and add to the overall quality of the area over their lifetime, are visually attractive, are sympathetic to local character and setting, while not preventing or discouraging appropriate innovation or change create attractive places to live, work and visit, optimise the potential of the site, and create places that are safe, inclusive and accessible and support community cohesion.

4.0 DESIGN APPROACH

4.1 Introduction

4.1.1 This section sets out the approach that the Applicant has taken to the design of the Proposed Development and how the design has evolved through the pre-application process.

4.2 Design Approach

4.2.1 The approach taken to the design of the Proposed Development has been informed by the context within which it would be situated, the opportunities and constraints presented by the Site, and the performance and environmental requirements identified in the FEED phase.

4.2.2 The immediate context of the Proposed Development Site (the 'Site') (e.g., the areas immediately surrounding the PCC Site) is very much industrialised in terms of its character and appearance. It is characterised by existing energy infrastructure associated with the VPI Immingham Power Station, adjacent Phillips 66 refinery and neighbouring Lindsey Oil Refinery. Given the site's context and the fact that is it free from environmental designations, a functional approach has been adopted to the design of the Proposed Development that is appropriate to the context and purpose of the Proposed Development for an efficient and safe Post Combustion Carbon Capture Plant. It is also important to recognise that this is not a situation where large-scale development is being introduced into an area that is devoid of built development and that is characterised by particularly sensitive landscapes.

Consideration of Alternatives

4.2.3 The consideration of reasonable alternatives and design evolution is constrained due to the aim of developing PCC plant for the CHP Plant to meet the identified national need for industrial decarbonisation, while avoiding and/or reducing adverse environmental effects (following the mitigation hierarchy of avoid, reduce and, if possible, remedy), as well as maintaining operational efficiency and cost-effectiveness, and considering other relevant matters such as available land and planning policy.

4.2.4 The alternative of ceasing operation of the CHP Plant GT1/ GT2/ auxiliary boilers is not considered to be an option given the economic significance of the VPI Immingham CHP Plant which supplies heat and power to the Humber Refinery and the adjacent Lindsey Oil Refinery.

Alternative Sites

4.2.5 Alternative sites with the Applicants' control were not considered, as the nature of the Proposed Development involves retrofitting the existing infrastructure with carbon capture technologies and therefore proximity to the existing units is a key consideration. The location for the Proposed VPI Development was selected for its availability and proximity to the CHP Plant. Land to the north of the CHP Plant is not available as it is already allocated to the potential development of an Open Cycle Gas Turbine (OCGT) Power Station for which a Development Consent Order was granted in 2020. Land to the west comprises the existing refineries, and land to the east is separated by a public highway (Rosper Road).

4.2.6 For this reason, there are no reasonable alternative sites.

Alternative Technologies

4.2.7 Alternative technologies to decarbonise the Proposed Development principally comprises hydrogen firing. This creates different and substantial dependencies on third parties to manufacture and transport sufficient quantities of hydrogen fuel. The method of manufacture of the hydrogen, and the percentage blend that the gas turbine is capable of combusting (with or without modifications), affect the extent of decarbonisation that can currently be achieved through hydrogen firing and at present there is insufficient hydrogen available for firing the VPI Immingham CHP Plant GT1 and GT2 so carbon capture is the only available option within the project timescales (i.e. completion around the end of 2027).

4.2.8 For this reason, alternative technologies are not considered feasible at this stage within the project timescales.

Alternative Design Options/ Layouts and Design Evolution

4.2.9 Alternative designs options have been explored through the pre-Front End Engineering Design (pre-FEED) process and ongoing FEED process for the Proposed Development. It is anticipated that the FEED processes will conclude in 2023.

4.2.10 As part of the ongoing design process, consideration has been given to a range of design options. Decisions taken regarding the concept design of the Proposed Development has, where relevant and possible, been informed by environmental appraisal and assessment work and by consultation with stakeholders.

4.2.11 To retain flexibility in the design, the maximum parameters, representing a worse case scenario, have been assessed within the differing layout options. As such, the technical assessments which comprise the submitted ES represent a reasonable worst-case assessment of the potential impacts of the Proposed Development at its current stage of design.

4.3 Design Evolution

4.3.1 The design process for the Proposed Development has been an iterative one.

4.3.2 A pre-FEED phase to determine the technical feasibility of the project was undertaken in three ‘work packages’, summarised below.

Configuration Selection

4.3.3 Configuration and technology options were explored with the technology suppliers, and evaluations were developed to take into account the overall project facilities, including process units, utility and offsites, site allocations, plot space requirement, comparative (+/-40%) capital and operational costs, CO2 emission reduction and hence levelised cost of CO2 avoided (LCOA).

4.3.4 The Proposed Configuration for the Humber Zero project was developed taking account of the site specific considerations for each site and process block. An initial Configuration Screening Report was assembled to summarise:

- Decarbonisation technologies considered;
- Site-specific considerations taken into account;
- Recommended central configuration for the project;

- Outcomes of the configuration screening workshop; and
- Cases to be taken forward for further techno-economic assessment.

4.3.5 The screening assessment provided a high-level assessment of potential technologies and configurations for decarbonisation (reduction of CO2 emissions) of the Humber Zero industrial cluster, with the aim of building consensus around a single configuration, presenting workable solutions, and screening out less attractive options. The Configuration Screening Assessment was undertaken in the following steps:

- Establish key principles upon which to base the screening of options
- Evaluate the extreme cases (full post-combustion vs full hydrogen fuelling) to establish the benefits / limitations of each
- Assess the potential site / process block to understand key design features and interfaces with other sites/blocks
- Develop matrix of options considering unit scaling, CO2 captured, residual CO2 emissions, H2 produced/consumed, steam produced/consumed
- Propose recommended central case for Humber Zero, including staged development
- Hold Configuration Screening Workshop with Humber Zero project partners
- Update central case for Humber Zero, including staged development, and alternative cases to be evaluated further

4.3.6 Certain elements of the chosen technology for the Proposed Development were favoured for several reasons, including:

- A proprietary amine based solvent CO2 capture process was selected as it is considered the only capture technology proven at a comparable commercial scale to achieve the Humber Zero Projects carbon capture target. The selection of unproven or new technology would have required qualification which adds risk to the project as it requires significant time and resources during project development.
- The choice of Cooling Medium System for the development through techno-economic evaluation. Both air and water cooling are widely used across industries, so all options are considered technically feasible. However, studies concluded that air cooling is the best performing option across a range of relevant criteria. The conclusion is that an all-air cooled solution is optimal and shall form the basis for the FEED development.

4.3.1 A summary of the design configuration options for the Proposed Development is provided in Table 4.1 below.

Table 4.1: Summary of design evolution for Proposed Development

Design Aspect	Summary of Options Considered
Cooling technology	Air and water cooling options were considered. Air cooling was selected over water cooling wherever possible to avoid significant increase in water demand given that water resources are already constrained in the region.
Carbon capture technology	Available carbon capture technology licensors were reviewed. Shell was selected as the preferred technology provider for a variety of reasons including design efficiency for CO_2 removal, technical viability, energy efficiency, cost and the fact that the Shell technology has been demonstrated technically at scale and in relevant applications.
Number of PCC trains	Layouts with two larger or three smaller PCC trains were considered. Two larger trains were selected to reduce the area of land required for the PCC plant.
Integration with CO_2 transport and storage network	Options to connect into Humber Low Carbon Pipeline and Viking CCS were considered. The Proposed VPI Development has been designed to allow for connection to either or both of these CO_2 transmission networks, maintaining operational and commercial flexibility.

Pre-FEED

4.3.2 In Pre-FEED, the process design, engineering definition, construction assumptions, implementation schedule and cost estimate were developed for the Humber Zero development. This included:

- Definition of the design basis for pre-FEED
- Development of the technical design deliverables which define the facility configuration in sufficient detail to support the cost estimate
- Identification of project risks
- Development of the implementation schedules
- Development of the capital cost estimate to a target accuracy of +/-30%
- Development of the operating cost estimate and economic modelling to calculate LCOA

4.4 FEED Scoping

4.4.1 In the third ‘work package’ the FEED contracting strategy was agreed, and the scope(s) of work, anticipated schedules and budget cost of the FEED services was developed, for the entire Humber Zero Project, in support of the submission for UKRI funding.

4.5 Design through Consultation

4.5.1 The Applicant carried out a comprehensive pre-application consultation exercise in respect of the Proposed Development.

4.5.2 The Applicant and Phillips 66 Limited undertook a joint consultation strategy which consisted of a stage of non-statutory consultation, held in March and April 2022 followed by further consultation (the 'Stage 2 Consultation') held in May 2022.

4.5.3 The objective of the Stage 1 Consultation was to introduce the Proposed Development and initial proposals, including the options being considered. The Stage 2 Consultation provided an update on the development and sought view on more detailed proposals in addition to updating consultees on the decisions made following Stage 1 Consultation. Four public consultation events were held within a 4km radius of the Site across both stages of consultation. These events gave participants (primarily local community members) the opportunity to express their opinions on the scheme design whilst helping to inform the Applicants' decision making.

4.5.4 Following Stage 1 consultation VPI was able to determine a number of design aspects and also confirm where flexibility would be retained, in accordance with the flexibility requirements set out earlier in this document.

4.5.5 The overall feedback from the local community in relation to the Proposed Development was supportive and, partially as a result of this it has not been necessary to design changes to the Proposed Development.

5.0 DESIGN

5.1 Introduction

5.1.1 This section of the DAS explains the flexibility that the Applicant has sought to incorporate within the design of the Proposed Development, within the overall parameters of the Application. It also explains the purpose and status of the design information that has been submitted as part of the Application in relation to use, layout, the amount of development, the scale of the main buildings and structures, appearance and the approach taken to landscaping.

5.2 Design flexibility

5.2.1 It is important to recognise that the Proposed Development (if approved) would be one of the first examples of post combustion carbon capture technologies being deployed at this scale in the UK. It has therefore been necessary to allow for an appropriate degree of flexibility in the design and layout of the Proposed Development, within the parameters of the Application.

5.2.2 A key reason for needing to incorporate flexibility within the Proposed Development at the consenting stage relates to the appointment of an Engineering Procurement and Construction ('EPC') contractor. This would not take place until after the application has received approval and the Applicant has made a final investment decision to proceed with the Proposed Development. Following the award of the construction contract, the appointed EPC contractor would then need to carry out a number of detailed design studies in order to inform the decisions on the exact technology/equipment selection for the various elements of the Proposed Development and also to optimise the design and layout of these. It is also important that the consent allows for changing economic conditions and the advancement of PCC technology in the period between preparing the Application and starting construction. At this stage of the process, it is not therefore possible to finalise the detailed design of the Proposed Development and conditions are anticipated to govern the future approval of these.

5.3 Use of Parameters

5.3.1 In order to provide sufficient flexibility and ensure a robust Environmental Impact Assessment ('EIA'), the principles of the 'Rochdale Envelope' approach have been adopted where appropriate. This involved assessing maximum design parameters for the elements of the Proposed Development where flexibility needs to be retained such as dimensions for the buildings and structures. A list of the submitted parameters plans is provided below:

- 415000-00201-8820-01-0001
- 415000-00201-8820-01-0002
- 415000-00201-8820-01-0003
- 415000-00201-8820-01-0014
- 415000-00201-8820-01-0015
- 415000-00201-8820-01-0016

- 415000-00201-8820-01-0017
- 415000-00201-8820-01-0018

5.3.2 The maximum design parameters for the main buildings and structures that have been adopted for the purposes of the EIA based on reasonable and appropriate worst-case assumptions. The maximum parameters for the Proposed Development are set out below in Table 5.1 below.

Table 5.1: Maximum Design Parameters

Development Component	Maximum Design Parameter
Absorber column and associated stack	110m height above ground level (114.9 m AOD)
CO2 regenerator/ stripper column	Up to 60 m height above ground level (64.9 m AOD)

5.4 Location and Context

5.4.1 The land to be developed currently comprises:

- Southern portion – grassland with an open ditch running west-east through the centre, areas of hardstanding and existing below ground utilities on the southern portion and
- Northern portion – area previously used for laydown during the construction of the existing VPI Immingham CHP Power Station (immediately to the north).

5.4.2 The Site therefore comprises a mix of brownfield and greenfield land. As explained in Section 3 of the Planning Statement which accompanies this application, the Site has been chosen because of lack of reasonable alternative nearby sites and the Site's availability and proximity to the CHP Plant to retrofit existing infrastructure with carbon capture technologies to reuse existing assets and reduce carbon emissions. The options to cease operation of the CHP are not reasonable given (respectively) the established need for industrial decarbonisation in the UK and economic significance of the VPI Immingham CHP Plant, which supplies heat and power to the Humber Refinery and adjacent Lindsey Oil Refinery. Similarly, the Site is in proximity to two proposed CO2 transportation network projects (Viking CCS and Zero Carbon Humber) which will allow for CO2 transportation and storage under the North Sea. The decision as to which network will be connected in to initially will be made following Government funding announcements.

5.4.3 The Site is immediately adjoined by the operational VPI Immingham CHP Plant in the north, farmland in the east, and the Network Railway Line in the south-east. There is also a Public Right of Way on the northern extent of the Site, which has been disused for a number of years, and an application to extinguish the ProW is currently being progressed.

5.4.4 The Site and its surrounds are relatively flat and low-lying land. The surrounding land-use is dominated by the large heavy industrial areas around the villages of Killingholme and Immingham, mixed with interspersed pockets of flat open farmland, woodland and natural coastal habitats. The Humber Estuary is located approximately 1.5km to the east with industrial activities along its banks.

5.4.5 The Sites fall within the Humber Estuary National Character Area (NCA) 41 which focuses on the low-lying estuarine landscape and its coastal habitats and ecosystems. The Site is also located within the Industrial Landscape Character Type (LCT) South Humber Gateway of the North Lincolnshire Landscape Character Assessment (1999). This LCT is dominated by industry, the key characteristics include remnant pockets of flat open farmland, woodland and natural coastal habitats interspersed within the dominant industrial infrastructure.

5.4.6 The Site is within the South Humber Bank Landscape initiative area which encourages the industrial and agricultural uses to have their security fencing stepped back and fringed with shrub trees, and use of vegetation screening.

5.5 Use and Components of the Proposed Development

5.5.1 The Proposed Development comprises a Post-combustion Carbon Capture (PCC) Plant and associated facilities for capturing CO2 from two of the gas turbines (GT1 and GT2) and two auxiliary boilers at the adjoining VPI Immingham CHP Plant.

Main Components

5.5.2 The Proposed Development will include the following components:

- ducting to connect GT1, GT2 and the auxiliary boilers to the PCC plant;
- two PCC units (or 'trains'), each with associated blower, direct contact cooler, absorber stack, stripper/ regenerator, thermal reclaimer unit and air-cooled heat exchangers;
- a CO2 vent stack for use during start up, shut down and emergencies only;
- CO2 compression facility with associated air-cooled heat exchangers;
- oxygen removal and dehydration facilities;
- CO2 metering and a pipeline connecting the PCC plant and compression facilities to the CO2 gathering network interface;

5.5.3 In addition to the main components described above (CO2 capture, compression and connection to the CO2 gathering network), the VPI Development will also require:

- electrical substations to supply the required electrical power to the PCC plant;
- chemical offloading storage and distribution facilities for caustic, solvent and other small quantities of chemicals (e.g. antifoam) required for the PCC plant;
- internal access roads providing access around the VPI Development and connecting the VPI Development to existing roads in and around the CHP Plant;
- surface water drainage system with an attenuation lagoon to manage uncontaminated surface water runoff and attenuate runoff on-site prior to discharge at the greenfield runoff rate;
- realignment of South Killingholme Drain through the VPI Site to facilitate the VPI Development – this has been discussed with the North East Lindsey Internal Drainage Board (NEL IDB) who manage the Drain for local flood risk management;

- construction and maintenance laydown areas, which are expected to be located on existing hardstanding within the existing CHP Plant and in the southernmost part of the VPI Site; and
- a new site access from Rosper Road, near the junction with Marsh Lane as seen in Drawing Ref. 60668666-ACM-XX-XX-DR-CE-0001.

5.5.4 There are no offices proposed as part of the Application. More information on the need for the Proposed Development, the components of which it comprises and how they work is provided in Section 3 of the Planning Statement and Chapters 3 and 4 of the ES which are submitted with the planning application alongside this document.

5.5.5 As mentioned above, the application for the Proposed Development makes use of parameters as shown in the Parameter Plans submitted as part of this application. The Proposed Development will therefore comprise of the following zones:

- VPI CO2 venting, treatment and compression;
- VPI CO2 transport to CO2 gathering network;
- electrical substations to supply the required electrical power to the PCC plant;
- chemical offloading storage and distribution facilities;
- internal access roads providing access in and around the Site and the CHP Plant;
- surface water drainage system;
- realignment of South Killingholme Drain through the Site;
- construction and maintenance laydown areas; and
- a new site access from Rosper Road near the junction with Marsh Lane .

5.6 Layout

5.6.1 A Layout has been submitted as part of the application which demonstrates how the Proposed Development might be laid out within the parameters.

5.6.2 The evolution of the plant layout was driven by the following principles:

- The design shall ensure that the plant and the activities during plant construction do not impact adversely on the HSE of the existing communities. “Zero Damage” shall be used as the starting point for the design and all deviations from the “Zero Damage Base Case” shall be justified.
- Provide a plant that is safe to construct, operate and maintain.
- Provide adequate separation distances between major process units, ignition sources and probable sources of flammable materials releases to limit disastrous accident effects to a single unit with no subsequent escalation and physical damage to another unit, recognizing that passive fire protection will be used where possible and necessary
- Provide safe separation distance between plant and manned buildings to prevent damage and potential injuries from explosions or jet fires or from mitigation of a potentially hazardous gas

cloud (e.g., large CO2 release). If adequate separation is not feasible, buildings shall be designed for worst credible accident scenario.

- Provide safe separation distance between plant and local community to avoid any disastrous accident effects to local residents.
- Provide adequate separation distance between equipment to allow safe shutdown of one equipment while hazardous condition exists in another item. Orientate equipment to maximise natural ventilation.
- Provide for segregation and separation of hazardous material inventories to reduce the potential of escalation.
- Permit safe evacuation of people inside the plant and those living close to the fence line during a disaster or major hazardous event.
- Protect vital emergency facilities such as fire water, main control room, emergency power supplies and fire stations and other populated buildings in the event of a fire or explosion.
- Permit safe access for emergency response personnel and emergency shutdown activities during a fire, gas release, or other incident.
- Minimise capital and operating costs while satisfying the above safety and maintenance requirements.
- Have efficient and cost-effective use of the land.
- Provide a plant that meets operability requirements.
- Provide a plant that meets constructability and maintainability requirements.
- Provide adequate security for plant personnel and equipment.

5.6.3 As set out in Section 4.0, the final design will depend on the chosen contractor and infrastructure and as such the layout is subject to change during the detailed design stage, within the parameters set out. As such, the corresponding technical assessments within the Environmental Statement have adopted a worst case scenario assumptions, using the maximum dimensions of the main components of the Proposed Development.

5.6.4 A network of internal access roads will be provided to allow for direct vehicular access to the various zones and components of the Proposed Development (such as laydown areas, work trains, storage and distribution facilities, electrical substations) by construction vehicles, maintenance operatives or the emergency services over the development's lifetime.

5.7 Amount

5.7.1 The VPI Site is 28.51 hectares ('ha'). The area for the proposed VPI PCC plant and CO2 compression is to the south of the existing Power Station. Development in this area consists of the following elements:

- ducting to connect GT1, GT2 and the auxiliary boilers to the PCC plant;

- two PCC units (or 'trains'), each with associated, blower, direct contact cooler, absorber, stack, stripper/ regenerator, air-cooled heat exchangers and a common thermal reclaimer unit;
- a CO2 vent stack for use during start up, shut down and emergencies only;
- CO2 compression facility with associated air-cooled heat exchangers;
- oxygen removal and dehydration facilities;
- CO2 metering and a pipeline connecting the PCC plant and compression facilities to the CO2 gathering network interface;
- on-site electrical substations;
- caustic, solvent and other chemical offloading and storage facilities;
- utilities (including chillers, steam generator, hydrogen package and air compressors)
- internal access roads;
- surface water drainage system;
- realignment of the existing ditch (South Killingholme Drain) within the VPI Site;
- construction and maintenance laydown areas; and
- a new site access from Rosper Road.

5.7.2 The northern part of the VPI PCC plant area was previously used for laydown during the construction of the existing VPI Immingham CHP Power Station. The southernmost part of the VPI Site will not be developed but it will be used for construction laydown for the Proposed Development.

5.7.3 The Proposed Development represents a modest intensification of land use adjacent to the operational VPI Immingham CHP Plant with a built pattern of development that is consistent with existing infrastructure at the CHP Plant and surrounding area. The amount of development is therefore considered acceptable.

5.8 Scale

5.8.1 The scale of the Proposed Development relates to the dimensions (length, width and height) of the structures that would be constructed and has been determined by technical requirements. All of the main structures will be located at the PCC Site with the maximum dimensions set out in Table 5.1 (Maximum Design Parameters). The dimensions of smaller buildings within the proposed development are listed in Table 5.2 below.

Table 5.2: List of proposed buildings including smaller buildings for which no floor and roof plans are included

Development Component	Dimensions	Floor and Roof Plans Drawing Reference.
Substation 04	52.6 (L) x 14.5 (W) x 8.5 (H) meters	415000-00201-8330-47-0003 415000-00201-8330-47-0004

Development Component	Dimensions	Floor and Roof Plans Drawing Reference.
Substation 05	38.1 (L) x 11.5 (W) x 8.5 (H) meters	415000-00201-8330-47-0012 415000-00201-8330-47-0013
Substation 06	45.3 (L) x 9.1 (W) x 8.5 (H) metres	No – substantially the same as substations 4 & 5.
Substation 07	45.3 (L) x 9.1 (W) x 8.5 (H) metres	No – substantially the same as substations 4 & 5.
Field Instrument Room 1	17 (L) x 12 (W) x 3 (H) meters and with extension of 7 (L) x 4 (W) x 3(H) meters for HVAC room	No - relatively small in the context of the Proposed Development and not generally occupied
Field Instrument Room 2	17 (L) x 11 (W) x 3 (H) meters and with extension of 7 (L) x 4 (W) x 3(H) meters for HVAC room	No - relatively small in the context of the Proposed Development and not generally occupied
Field Instrument Room 3	11.5 (L) x 10 (W) x 3 (H) meters and with extension of 7 (L) x 4 (W) x 3(H) meters for HVAC room	No - relatively small in the context of the Proposed Development and not generally occupied
Field Instrument Room 4	11.5 (L) x 10 (W) x 3 (H) meters and with extension of 7 (L) x 4 (W) x 3(H) meters for HVAC room	No - relatively small in the context of the Proposed Development and not generally occupied
Train 1 CO2 Compressor House	42 (L) x 28 (W) x 27 (H) metres	415000-00201-8330-47-0005 415000-00201-8330-47-0007
Train 2 CO2 Compressor House	42 (L) x 28 (W) x 27 (H) metres	
Train 1 MVR Compressor House	16 (L) x 10 (W) x 15.5 (H) metres	
Train 2 MVR Compressor House	16 (L) x 10 (W) x 15.5 (H) metres	415000-00201-8330-47-0006
Instrument Air Compressor Shelter	13 (L) x 12 (W) x 7 (H) meters	No - not a building
Analyser House 1 A	6 (L) x 3 (W) x 3 (H) meters	No - small in the context of the Proposed Development and not generally occupied
Analyser House 2	4 (L) x 3 (W) x 3 (H) meters	No - small in the context of the Proposed Development and not generally occupied
Analyser House 3	4 (L) x 3 (W) x 3 (H) meters	No - small in the context of the Proposed Development and not generally occupied
Analyser House 1B	6 (L) x 3 (W) x 3 (H) meters	No - small in the context of the Proposed Development and not generally occupied
Continuous Emission Monitoring Sys House 1	2 (L) x 2 (W) x 2.1 (H) meters	No - small in the context of the Proposed Development and not generally occupied
Continuous Emission Monitoring Sys House 2	2 (L) x 2 (W) x 2.1 (H) meters	No - small in the context of the Proposed Development and not generally occupied

Development Component	Dimensions	Floor and Roof Plans Drawing Reference.
Fiscal Metering Analyser House	4 (L) x 4 (W) x 4 (H) meters	No - small in the context of the Proposed Development and not generally occupied
STG Acoustic Enclosure	18 (L) x 10 (W) x 10 (H) meters	No - not a building

5.8.2 The Proposed Development will contain only the infrastructure necessary to operate the PCC which will be designed for up to 95% CO2 capture during steady state operation. An example of how this may look is shown in the general arrangement plans submitted as part of this application. A list of the submitted general arrangement plans is provided below:

- 415000-00201-8820-01-0004
- 415000-00201-8820-01-0005
- 415000-00201-8820-01-0006
- 415000-00201-8820-01-0007
- 415000-00201-8820-01-0008
- 415000-00201-8820-01-0009
- 415000-00201-8820-01-0010
- 415000-00201-8820-01-0011
- 415000-00201-8820-01-0012
- 415000-00201-8820-01-0013

5.9 Landscaping

5.9.1 The Proposed Development does not include substantial landscaping provision, being within an overwhelming industrial context and surrounded by existing apparatus, notably the VPI Power Station and CHP Plant, to which the Proposed Development will connect to, if approved. Additionally, due to the scale of the Proposed Development and surrounding infrastructure, no amount of landscaping would provide sufficient mitigation or screening. The PCC Plant does not propose any disproportionately large development, when viewed in the context of the Site and the context of Humber. Notable developments of similar scale consented in the surrounding area are discussed in Section 2.0. We anticipate conditions would govern the provision of limited boundary treatments and ancillary amenity planting.

5.10 Appearance

5.10.1 Chapters 3 and 4 of the ES covers the design parameters of the Proposed Development and Chapter 11 assesses the appearance in terms of landscape and visual amenity impacts. It concludes that the construction impacts would be temporary and limited to the movement of plant and heavy goods vehicles, crane activity, temporary stockpiling and storage of materials,

temporary site compound structures, and external lighting, all of which would be dealt with by suitably worded planning conditions.

5.10.2 The appearance of permanent buildings and structures (such as the stacks and absorbers) in terms of building finishes and exact sizes of component parts would be finalised during final detailed design and secured by way of planning conditions which cover the siting, layout, scale and external appearance, including colour, materials and surface finishes. Further to this, air quality modelling concludes that the appearance of plumes from the proposed absorber stack would not have a significant adverse impact to warrant mitigation measures, given the extent and frequency of visibility. Further to this, the landscape and visual impact assessment concludes that the appearance of the Proposed Development (including plumes from stacks) would be characteristic of the context and would not have a significant adverse impact in terms of its appearance within the landscape or to visual receptors and would represent some intensification of industrial uses and character.

5.10.3 Notwithstanding the above, a range of avoidance and mitigation measures would be employed and secured by planning conditions to address the scale and appearance of the Proposed Development, including:

- materials and finishes selected with longevity in mind to minimise maintenance requirements;
- suitable materials to reduce reflection and glare, soften massing and bulk, achieve visual consistency with adjoining buildings and other infrastructure; and
- suitable lighting schemes that minimise glare and light pollution.

5.11 Flood Risk Assessment

5.11.1 As the Proposed Development is located within Flood Zone 3, a number of associated mitigation measures are proposed in Chapter 9 of the ES. Flood risk to the Proposed VPI Development from tidal sources and Ordinary watercourses is considered to be a residual risk. Development defined as critical infrastructure for the Proposed VPI Development will be located at existing ground level for operational reasons. Therefore, flood resilience and resistance measures will be put in place (see Section 7.2 of the ES Appendix 9A) (where practicable), as with other critical infrastructure within the VPI Immingham CHP Site. Furthermore, in the event that below ground infrastructure is proposed during the detailed design phase, this shall be designed to withstand hydrostatic pressures and built with flood resilient materials. Surface water will be discharged to South Killingholme Drain at a restricted greenfield rate.

5.12 Security and Community Safety

5.12.1 During both construction and operation, access to the Site will be strictly controlled. VPI Immingham has well established security protocols including controlled access points, manned kiosk and vehicle booking systems. The security measures at VPI Power Station, will therefore be implemented at the Proposed Development Site where construction personnel and site operatives will be subject to these security measures. With regards to physical design, the

Proposed Development Site will include similar security measures at the VPI Power Station such as perimeter fencing, CCTV/security cameras and motion sensor lighting.

5.12.2 It is considered that further design details covering security and safety, and external lighting measures would be covered by a suitably worded planning condition/s.

5.12.3 Lighting will be provided to achieve the level of illumination necessary for safe operation and maintenance of the Proposed Development and designed to reduce glare and sky glow as well as minimise energy use and associated carbon emissions.

5.12.4 External lighting will be of LED type mounted on poles. The light source will be at height of approximately 10 m. All outdoor lighting will be switched on and off centrally by means of photocells or timers.

5.12.5 The Proposed Development's absorber stacks will be fitted with aviation warning lighting as required by the Civil Aviation Authority.

5.13 Environmental Sustainability and Climate Change Considerations

5.13.1 When fully installed and operational, the Proposed VPI Development would capture 95% of the flue gases directly emitted from the CHP plant at the VPI site. When factoring in other emission sources identified at the Proposed VPI Development such as waste, maintenance etc, the direct carbon capture rate, relative to baseline conditions, is estimated to be 95%. The overall outputs of VPI remain unchanged after the construction of the PCC plant therefore the carbon capture rate % remains unchanged. The overall carbon capture rate is reduced to 82% when upstream emissions from the wider value chain are taken into account. These are associated with the extraction, refining and transportation of the natural gas over which VPI have less control[1]. The UK Government's Net Zero Strategy (2021) which proposes to deliver four CCUS clusters, capturing 20-30 MtCO2 across the economy, including 6 Mt CO2 of industrial emissions, per year by 2030. This implies a commitment of between 14-24 MtCO2 per year to be captured from energy source, of which the Proposed Development would assist in capturing. Further to this, the Proposed Development would result in a net decrease in CO2 emissions when the anticipated operational and construction emissions are considered (Chapter 14 of the ES and Section 6 Climate Change and Carbon of the Planning Statement).

[1] This does not include emissions from the combustion refinery products by end users

6.0 ACCESS

6.1 Introduction

6.1.1 This section of the DAS sets out the approach the Applicant has taken to the access of the Proposed Development. The Proposed Development will utilise the existing accesses to the VPI Site. The VPI Site is currently accessed from three junctions with Rosper Road. A new site access will be erected from Rosper Road near the junction with Marsh Lane. The general arrangement of the new Site access is detailed in Drawing Ref. 60668866-ACM-XX-XX-DR-CE-0001-P03.

6.1.2 It is Proposed that the new site access will be used for construction traffic, maintenance, and emergency access. The southern access will also be used for construction traffic but will have no ongoing function following construction.

6.2 Access During Construction

6.2.1 A new access is proposed to be constructed from the public highway (Rosper Road) into the VPI Site. This new access will be used as the main HGV access and egress during construction and for maintenance and emergency use during operation. Staff access will be via the existing main entrance to the CHP Plant. A network of internal access roads will accommodate HGV movements around the development Site. The access and internal arrangements are shown in Drawing Ref. 415000-00201-8820-01-0001.

6.2.2 Traffic Management (TM) methods would be used to enhance safety conditions on the strategic road network (SRN) and the local road network (LRN) and where physical mitigation measures are impractical or cannot be accommodated during the construction period.

6.2.3 Several mitigation measures are also proposed to reduce the impact of the construction traffic upon the highway and the local community as efficiently and successfully. Such measures are discussed in Chapter 8 (Traffic and Transport) of the submitted ES and include prescribed HGV and LGV construction routes, community engagement, production of a travel plan, prescribed working hours, a Delivery Management System and wheel washing facilities.

6.3 Access During Operation

6.3.1 The primary access during operation will be via the existing VPI access from Rosper Road, approximately 295m north west of Marsh Lane. It is expected that only a limited number of vehicular trips associated with maintenance of the Proposed Development would be generated. These would be expected to occur at regular intervals in which there would be advanced scheduling of such movements to minimise likelihood of disruption to the highway network.

6.4 Access During Decommissioning

6.4.1 The Site access arrangements during the decommissioning phase are expected to be similar to the construction phase, with similar vehicle movements and highways safety considerations, and equal or less traffic generated.

6.5 Emergency and Fire Service Access

6.5.1 The Site access for emergency and fire services would be the same as those during construction and operation of the Proposed Development, which would accommodate access and egress for HGVs and their movement around the Proposed Development. It is therefore considered to be suitable for these purposes.

7.0 SUMMARY AND CONCLUSIONS

7.1.1 This DAS sets out how the Applicant has had regard to design and access considerations in designing the Proposed Development. The document explains how the Site's context, wider setting and planning policy has been taken into account in the design of the Proposed Development.

7.1.2 While appropriate flexibility has been sought in the design of the Proposed Development, the Applicant has defined design parameters upon which to base the EIA to ensure that the likely significant effects of the Proposed Development have been robustly assessed and to ensure that the detailed design of the Proposed Development is controlled and secured.

7.1.3 The design of PCC Plant is functional, reflecting its purpose and the context within which it will sit. In terms of siting and layout, the plant will connect to the existing VPI CHP Plant and is entirely consistent with the design of development in the VPI Immingham Power Station and surrounding area.

7.1.4 In conclusion, it is considered that the Proposed Development represents 'good design' for the purposes of energy infrastructure.