



# Hornsea Project Four

## Outline Design Plan

**Deadline: 4, Date: 10 May 2022**

**Document Reference: F2.13**

**Revision: 02**

**Prepared** Ørsted, May 2022

**Checked** Ørsted, May 2022

**Accepted** Thomas Watts, Ørsted, May 2022

**Approved** Julian Carolan, Ørsted, May 2022

F2.13

Version B

## Revision Summary

<i>Rev</i>	<i>Date</i>	<i>Prepared by</i>	<i>Checked by</i>	<i>Approved by</i>
01	29/09/2021	Orsted	Thomas Watts	Julian Carolan
02	10/05/2022	Orsted	Thomas Watts	Julian Carolan

## Revision Change Log

<i>Rev</i>	<i>Page</i>	<i>Section</i>	<i>Description</i>
01	N/A	N/A	Submitted as part of DCO Application
02	21	Figure 6	Amendment to Figure 6 specifying indicative colours in response to ISH2.
02	15	Table 3	Additional clarity regarding OnSS MDS to ensure consistency, further to clarification provided at Deadline 4.
03	13	6.2	Removal of word 'approximately' as set out in G1.6: OnSS and EBI Ground Levels Clarification Memo (AS-024).

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## Glossary

Term	Definition
Commitment	<p>A term used interchangeably with mitigation and enhancement measures. The purpose of Commitments is to reduce and/or eliminate Likely Significant Effects (LSEs), in EIA terms.</p> <p>Primary (Design) or Tertiary (Inherent) are both embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, Preliminary Environmental Information Report (PEIR) or ES).</p> <p>Secondary commitments are incorporated to reduce LSE to environmentally acceptable levels following initial assessment i.e. so that residual effects are acceptable</p>
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Energy Balancing Infrastructure (EBI)	The onshore substation includes energy balancing Infrastructure. These provide valuable services to the electrical grid, such as storing energy to meet periods of peak demand and improving overall reliability.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).
Environmental Statement (ES)	A document reporting the findings of the EIA and produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.
Export Cable Corridor (ECC)	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Project Four array area to the Creyke Beck National Grid substation, within which the export cables will be located.
High Voltage Alternating Current (HVAC)	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
High Voltage Direct Current (HVDC)	High voltage direct current is the bulk transmission of electricity by direct current (DC), whereby the flow of electric charge is in one direction.
Hornsea Project Four offshore wind farm	The term covers all elements of the project (i.e. both the offshore and onshore). Hornsea Four infrastructure will include offshore generating stations (wind turbines), electrical export cables to landfall, and connection to the electricity transmission network. Hereafter referred to as Hornsea Four.
Mitigation	A term used interchangeably with Commitment(s) by Hornsea Four. Mitigation measures (Commitments) are embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, PEIR or ES).
National Grid Electricity Transmission (NGET) substation	The grid connection location for Hornsea Four.

Term	Definition
Onshore substation (OnSS)	Comprises a compound containing the electrical components for transforming the power supplied from Hornsea Project Four to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid. If a HVDC system is used the OnSS will also house equipment to convert the power from HVDC to HVAC.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).

## Acronyms

Acronym	Definition
AOD	Above Ordnance Datum
DCO	Development Consent Order
DECC	Department for Environment and Climate Change
EBI	Energy Balancing Infrastructure
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ERYC	East Riding of Yorkshire Council
ES	Environmental Statement
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LSE	Likely Significant Effects
MHWS	Mean High Water Springs
NGET	National Grid Energy Transmission
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OnSS	Onshore Substation
PEIR	Preliminary Environmental Information Report
PRoW	Public Right of Way
SoS	Secretary of State

## Units

Unit	Definition
dB	Decibel
kV	Kilovolt (electrical potential)
m	meters
Km	kilometers

## 1 Introduction

1.1.1.1 Orsted Hornsea Project Four Limited (the 'Applicant') is proposing to develop the Hornsea Project Four Offshore Wind Farm (hereafter 'Hornsea Four') which will be located approximately 69 km offshore the East Riding of Yorkshire in the southern North Sea and will be the fourth project to be developed in the former Hornsea Zone. Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall, and on to an onshore substation (OnSS) with energy balancing infrastructure (EBI), and connection to the electricity transmission network.

1.1.1.2 Details of the activities and infrastructure associated with Hornsea Four are fully set out in [Volume A1, Chapter 4: Project Description](#). In summary, the onshore elements of Hornsea Four will comprise of:

- **Landfall** – including transition joint bays connecting the offshore export cable corridor (ECC) and onshore ECC, one temporary landfall compound and temporary access tracks;
- **Onshore ECC** – including the onshore export cables, eight temporary logistics compounds, joint bays and link boxes, and temporary access tracks;
- **OnSS and EBI** – including the temporary working area, temporary and permanent access tracks, the permanent working area (inclusive of the OnSS, EBI and associated landscaping and attenuation feature(s)); and,
- **400 kV National Grid Electricity Transmission (NGET) connection area** – the area within which a 400 kV section of the onshore ECC will connect to the existing National Grid Electricity Transmission (NGET) substation at Creyke Beck.

## 2 Purpose and Implementation of the Outline Design Plan

2.1.1.1 The Outline Design Plan sets out measures to inform the detailed design of the Hornsea Four OnSS and EBI. In the event that Hornsea Four is granted development consent, a detailed Design Plan will be prepared and agreed with the relevant planning authority prior to construction of Development Consent Order (DCO) Work No. 7, in accordance with the principles established in this Outline Design Plan. This is secured by Requirement 7 of the draft DCO ([Volume C1.1](#)) which states:

*7.- (1) Construction of the connection works in Work No. 7 shall not commence until details of—*

*(a) the layout;*

*(b) scale;*

*(c) proposed finished ground levels;*

*(d) external appearance and materials;*

*(e) hard surfacing materials;*

*(f) vehicular and pedestrian access, parking and circulation areas;*

*(g) minor structures, such as furniture, refuse or other storage units, signs and lighting;*

*(h) proposed and existing functional services above and below, ground, including drainage, power and communications cables and pipelines, manholes and supports; and*

*(i) means to control operational noise from Work No.7 to a level no greater than 5dB above representative background (LA90,T) at the nearest identified noise sensitive receptors;*

*relating to that work of the authorised project have been submitted to and approved in writing by the relevant planning authority.*

*(2) The details submitted under sub-paragraph (1) must be in accordance with the outline design plan.*

*(3) The connection works in Work No. 7 must be carried out in accordance with the approved details.*

*(4) The connection works in Work No. 7 shall not commence until confirmation of the choice of HVDC or HVAC has been provided in writing to the relevant planning authority, either before, or at the same time as, the details referred to in paragraph (1).*

2.1.1.2 The production of an Outline Design Plan fulfils project Commitment 195 (**Volume A4, Annex 5.2: Commitment Register**) and secures measures for the detailed design of the OnSS and EBI, some of which has been identified as secondary mitigation measures as set out in **Volume A3: Onshore Environmental Assessment**.

### **3 Commitments**

3.1.1.1 The Applicant has developed a range of Commitments to eliminate or reduce impacts and effects as far as possible. All Commitments identified for Hornsea Four are detailed within the Commitments Register (see **Volume A4, Annex 5.2: Commitments Register**).

3.1.1.2 The Commitments Register includes a number of commitments relevant to detailed design (see **Table 1**).

**Table 1: Detailed Design Commitments.**

Commitment ID	Measure Proposed	How the measure will be secured
Co49	Primary: There will be no permanent High Voltage infrastructure installed above surface within 110 m of residential properties and sub surface infrastructure (including the onshore export cable) within 50 m of residential properties	DCO Requirement 7 (Detailed design approval onshore)
Co145	Primary: Views of Beverley Minster from the A1079 will not be obstructed by the siting of the onshore substation.	DCO Requirement 7 (Detailed design approval onshore)
Co151	Primary: No above ground infrastructure associated with Hornsea Four will obstruct the view from St Mary's Church Cottingham to Beverley Minister through considered design of the OnSS and site selection.	DCO Requirement 7 (Detailed design approval onshore)
Co169	Secondary: Piling at the Onshore Substation (OnSS) will not be undertaken within 180m of any noise sensitive receptors.	DCO Requirement 7 (Detailed design approval onshore)
Co193	Secondary: Operational site lighting at the onshore substation will be designed in accordance with latest relevant available guidance and legislation and the details of the location, height, design and luminance of lighting to be used will be provided as part of detailed design for the onshore substation. The design of operation site lighting will accord with the details provided in the Outline Design Plan (Co195) and Outline Ecological Management Plan (Co168).	DCO Requirement 7 (Detailed design approval onshore)
Co195	Secondary: Detailed design will be developed for the Onshore Substation in accordance with the Outline Design Plan which will include details regarding design and access. Examples of such detailed design information includes (but are not limited to): building heights and form; site layout; external appearance and colours; vehicular and pedestrian access.	DCO Requirement 7 (Detailed design approval onshore)



## 4 Implementation Approach

### 4.1 Objectives

- 4.1.1.1 This document provides outline design information to inform the detailed design of the Hornsea Four OnSS and EBI and aligns with the ambition of securing a high-quality ethos of design outlined within [Volume A4, Annex 4.6: Design Vision Statement](#). The Outline Design Plan will inform the layout, scale, amended ground levels, materiality and application of colour, vehicular and pedestrian access, minor structures and services, associated with the detailed design of the OnSS.
- 4.1.1.2 The information detailed within this Outline Design Plan are visualised and described as though integrated within the indicative OnSS and EBI layouts; however, it is important to note that these indicative layouts are subject to optimisation and change within the Detailed Design Plan post consent, within the maximum design parameters set out in [Volume A1, Chapter 4: Project Description](#). This Outline Design Plan secures the principle design elements only as required by Requirement 7 of the draft DCO ([Volume C1.1](#)).
- 4.1.1.3 This Outline Design Plan sits within a wider suite of documents (as shown in [Figure 1](#) which utilises the same colour scheme to denote levels) which comprise the following:

#### DCO Parameters and Maximum Design Scenario

[Volume C1.1: Hornsea Four Draft Development Consent Order](#) – Consents the overarching maximum parameters associated with Hornsea Four infrastructure.

[Volume A1, Chapter 4: Project Description](#) – Further refines the maximum design scenario (MDS) for the Hornsea Four infrastructure providing additional parameters not outlined in the draft DCO.

#### Detailed Design

[Volume F2, Chapter 13: Outline Design Plan](#) – Provides the outline approach and key embedded design mitigations of the OnSS and EBI which will inform the detailed design to be approved under Requirement 7 of the draft DCO.

#### Mitigation Measures

[Volume A3, Chapter 1-10: Onshore Environmental Assessment](#) – Comprises ten environmental topic areas subject to Environmental Impact Assessment (EIA), setting out primary, tertiary and secondary mitigation measures (secured through various DCO provisions as identified in [Volume A4, Annex 5.2: Commitments Register](#)) to avoid or reduce environmental effects.

[Volume F2, Chapter 8: Outline Landscape Management Plan](#) - Sets out the outline approach to landscaping works which will inform the detailed landscaping to be approved under Requirement 8 of the draft DCO. The indicative landscape masterplan also includes some embedded enhancement measures.

Further mitigation measures associated with Hornsea Four are secured in the Outline Ecological Management Plan ([Volume F2, Chapter 3](#)), Outline Onshore Infrastructure Drainage Strategy ([Volume F2, Chapter 6](#)), Outline Onshore Written Scheme of Investigation ([Volume F2, Chapter 10](#)), Outline Code of Construction Practice ([Volume F2, Chapter 2](#)).

## Biodiversity Net Gain

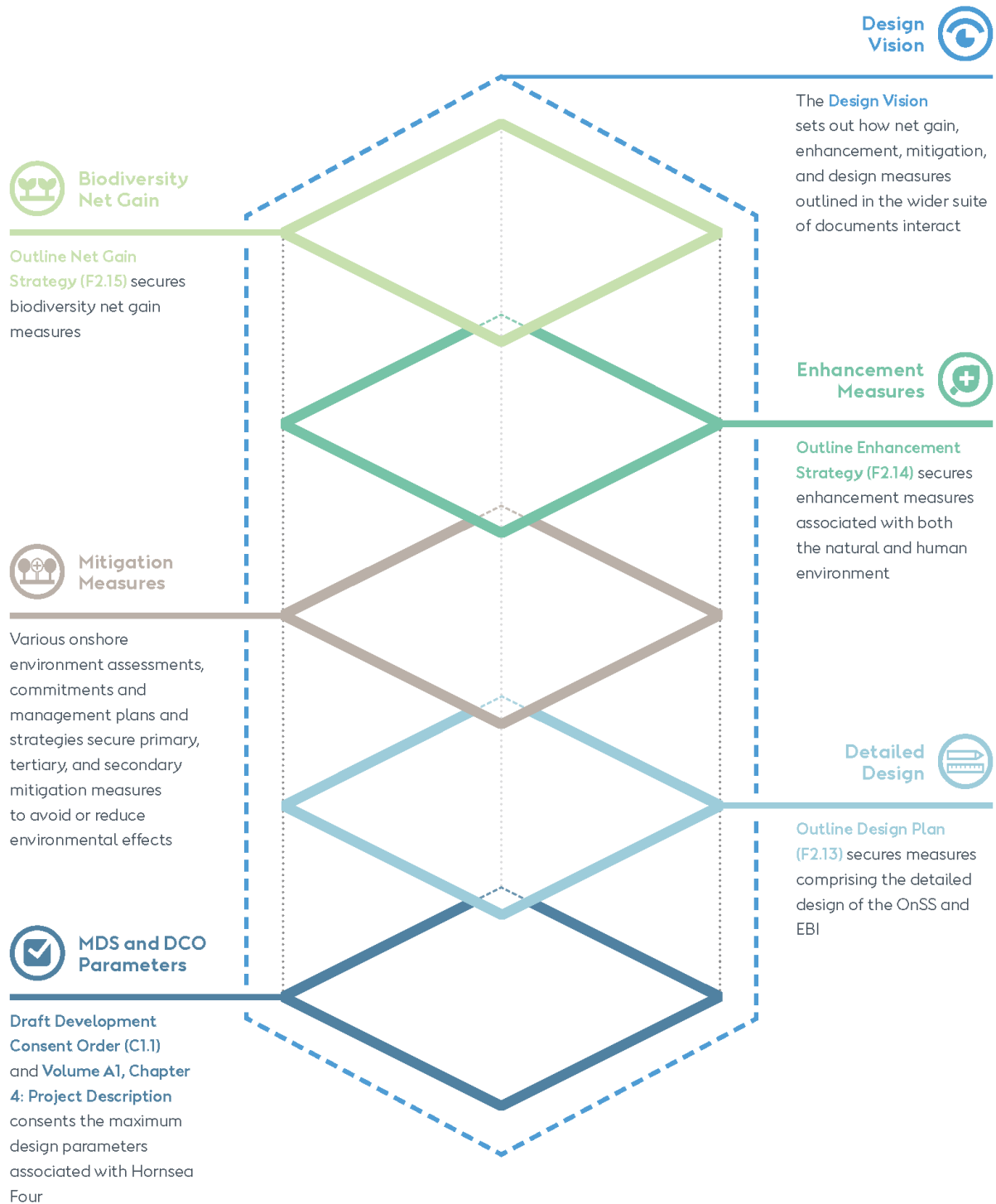
**Volume F2, Chapter 16: Outline Net Gain Strategy** – Covering only matters that are measurable, linked to biodiversity net gain. The outline measures will be developed further post-consent of Hornsea Four and approved under Requirement 6 of the draft DCO.

## Enhancement Measures

**Volume F2, Chapter 14: Outline Enhancement Strategy** – Sets out outline enhancement measures (measures identified over and above mitigation measures) associated with both the natural and human environment. The outline measures will be developed further post-consent of Hornsea Four and approved under Requirement 22 of the draft DCO.

## Design Vision

The core principals of each of the documents outlined above are combined in **Volume A4, Annex 4.6: Design Vision Statement**. This document presents the 'vision' of Hornsea Four, setting out how the project design, mitigation, enhancement and net gain measures interact. This interaction is further illustrated in **Figure 1**. The core elements of the Design Vision Statement including the relevant project mitigations are secured via respective elements of the draft DCO (**Volume C1.1**) (the most relevant of which are outlined in the above boxes). The Design Vision Statement is therefore provided as a visual aid only.



**Figure 1: Hornsea Four design vision and component parts.**

## 5 Planning and Policy Context

### 5.1 National Planning Policy

5.1.1.1 Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIP), specifically in relation to design is contained in the National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-1, Department for Environment and Climate Change (DECC), 2011). These are summarised in [Table 2](#).

**Table 2. Summary of NPS EN-1 policy provision relevant to design.**

Summary of NPS EN-1 Provisions	How and Where Considered
<p><i>"The visual appearance of a building is sometimes considered to be the most important factor in good design. But high quality and inclusive design goes far beyond aesthetic considerations. The functionality of an object — be it a building or other type of infrastructure — including fitness for purpose and sustainability, is equally important. Applying "good design" to energy projects should produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible. It is acknowledged, however that the nature of much energy infrastructure development will often limit the extent to which it can contribute to the enhancement of the quality of the area"</i> (EN-1, paragraph 4.5.1).</p>	<p>The design of Hornsea Four has considered the surrounding landscape throughout the route planning and site selection (RPSS) process (<a href="#">Volume A1, Chapter 3: Site Selection and Consideration of Alternatives</a>).</p> <p>The design of onshore aboveground infrastructure (the OnSS and EBI) ensures good design through the provision and balance of high quality technical and health and safety requirements, technical functionality and high quality engineering, and aesthetic design.</p>
<p><i>"Good design is also a means by which many policy objectives in the NPS can be met, for example the impact sections show how good design, in terms of siting and use of appropriate technologies can help mitigate adverse impacts such as noise"</i> (EN-1, paragraph 4.5.2).</p>	<p>The siting and design of Hornsea Four's onshore infrastructure has had due consideration of NPS policy objectives associated with specific impact assessments, through the RPSS process (<a href="#">Volume A1, Chapter 3: Site Selection and Consideration of Alternatives</a>), with specific policy objectives covered in respective technical chapters in <a href="#">Volume 3</a>.</p> <p>In respect of noise impacts, <a href="#">section 6.5</a> details the operational noise mitigation measures identified during this early phase of OnSS design.</p>

Summary of NPS EN-1 Provisions	How and Where Considered
<p><i>"In the light of the above, and given the importance which the Planning Act 2008 places on good design and sustainability, the IPC [hereafter the Secretary of State (SoS)] needs to be satisfied that energy infrastructure developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable and adaptable (including taking account of natural hazards such as flooding) as they can be. In so doing, the SoS should satisfy itself that the applicant has taken into account both functionality (including fitness for purpose and sustainability) and aesthetics (including its contribution to the quality of the area in which it would be located) as far as possible. Whilst the applicant may not have any or very limited choice in the physical appearance of some energy infrastructure, there may be opportunities for the applicant to demonstrate good design in terms of siting relative to existing landscape character, landform and vegetation. Furthermore, the design and sensitive use of materials in any associated development such as electricity substations will assist in ensuring that such development contributes to the quality of the area" (EN-1, paragraph 4.5.3).</i></p>	<p>The Applicant has endeavoured to ensure the attractiveness, durability and adaptability of Hornsea Four where feasible (whilst ensuring technical and health and safety requirements are achieved). Associated matters are secured via the Order Limits, project parameters (<a href="#">Volume A1, Chapter 4: Project Description</a>) and this Outline Design Plan.</p> <p>The contribution of the OnSS and EBI to the local landscape was considered during the RPSS process (<a href="#">Volume A1, Chapter 3: Site Selection and Consideration of Alternatives</a>), and opportunities for improving aesthetics have been explored with an external landscape design consultant, as presented in <a href="#">section 7</a> with landscaping proposals detailed in <a href="#">Volume F2, Chapter 8: Outline Landscape Management Plan</a>.</p>
<p><i>"For the SoS to consider the proposal for a project, applicants should be able to demonstrate in their application documents how the design process was conducted and how the proposed design evolved. Where a number of different designs were considered, applicants should set out the reasons why the favoured choice has been selected. In considering applications the SoS should take into account the ultimate purpose of the infrastructure and bear in mind the operational, safety and security requirements which the design has to satisfy" (EN-1, paragraph 4.5.4).</i></p>	<p>The evolution of the overall design of Hornsea Four is detailed in process <a href="#">Volume A1, Chapter 3: Site Selection and Consideration of Alternatives</a>.</p> <p>This Outline Design Plan guides the detailed design for the OnSS and EBI (the only Hornsea Four onshore aboveground infrastructure), considering aesthetics within the constraints of technical feasibility and health and safety requirements.</p>
<p><i>"Applicants and the SoS should consider taking independent professional advice on the design aspects of a proposal. In particular, Design Council CABE can be asked to provide design review for nationally significant infrastructure projects and applicants are encouraged to use this service" (EN-1, paragraph 4.5.5).</i></p>	<p>The Applicant has obtained independent professional advice on the design of the Hornsea Four OnSS and EBI and indicative landscape planting, with the aim of minimising landscape and visual impacts.</p> <p>The technical and health and safety requirements of the OnSS and EBI is informed by specialists on behalf of the Applicant, directed by design standards and requirements. These combined with independent design advice ensure the OnSS and EBI is fit for purpose.</p>

5.1.1.2 The National Infrastructure Commissions Design Principles for National Infrastructure makes reference to design quality through the four key principles (climate, people, places and value). The document specifies a number of goals related to design, which have been accounted for where possible throughout the Hornsea Four documents prepared (within the documents outlined in [paragraph 4.1.1.3](#)).

## 6 Building form, composition and layout

6.1.1.1 The following sections outline the maximum parameters of the OnSS and EBI (as outlined in [Volume 1, Chapter 4: Project Description](#)), along with the outline design approach to the built form elements, led by engineering requirements and where feasible, inspired by local vernacular. The key aims of the building form, composition and layout options include:

- Producing a buildable and operational scheme that satisfies engineering requirements,
- Allowing for emergency and maintenance access,
- Reducing the visual impact where feasible through mitigation, and
- Creating a consistent design standard throughout the OnSS and EBI, where feasible, to avoid or reduce visual clutter.

6.1.1.2 The building form, composition and layout of the OnSS and EBI will accord with the commitments identified in [Table 1](#).

### 6.2 Proposed Finished Ground Levels – DCO Requirement 7(1)(c)

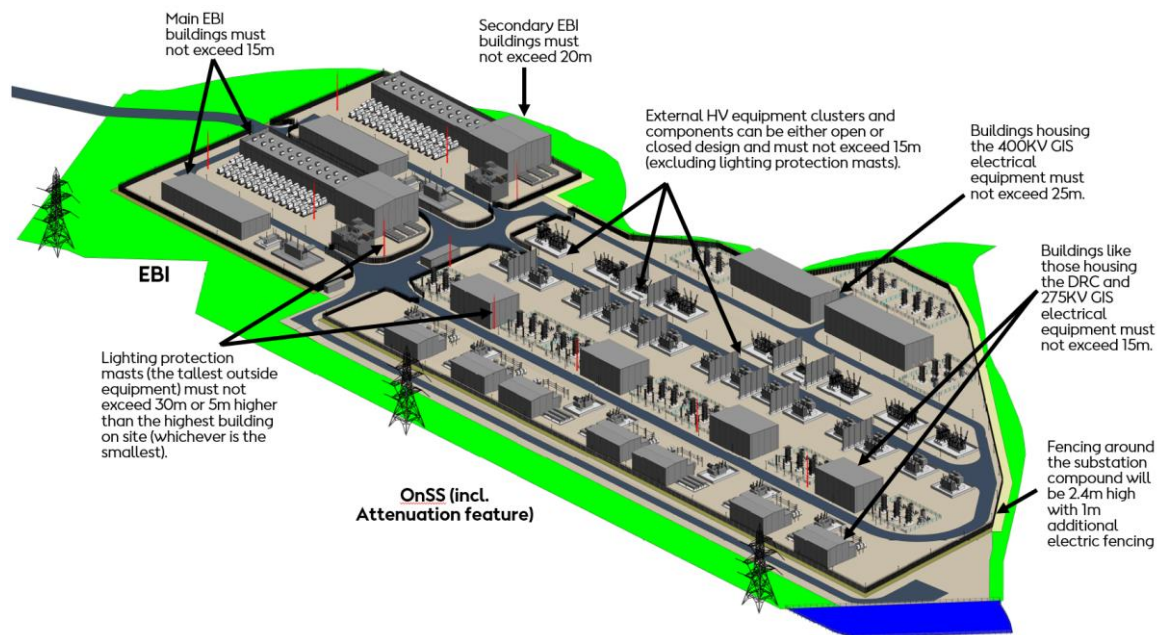
6.2.1.1 The permanent OnSS infrastructure is likely to be set at the finished ground levels outlined below. However, these levels will be dependent on the detailed design to be developed and approved (via Requirement 7 of the DCO, with ERYC) post-consent. As such, the final site levels will be agreed in consultation with the relevant authorities, including the Environment Agency and lead local flood authority (LLFA), as necessary and included within the Detailed Design Plan:

- The area identified in the indicative HVAC and HVDC layouts for the OnSS (see [Figure 2](#) and [Figure 3](#)) is anticipated to be set at 13.0m AOD – This is 2.5m above the maximum modelled flood extent for the 1 in 1,000 year plus climate change event and therefore inherently includes a significant natural freeboard .
- The area identified in the indicative HVAC and HVDC layouts for the EBI (see [Figure 2](#) and [Figure 3](#)) is anticipated to be set at 14.5m AOD – This is 4.0m above the maximum modelled flood extent for the 1 in 1,000 year plus climate change event and therefore inherently includes a significant natural freeboard .

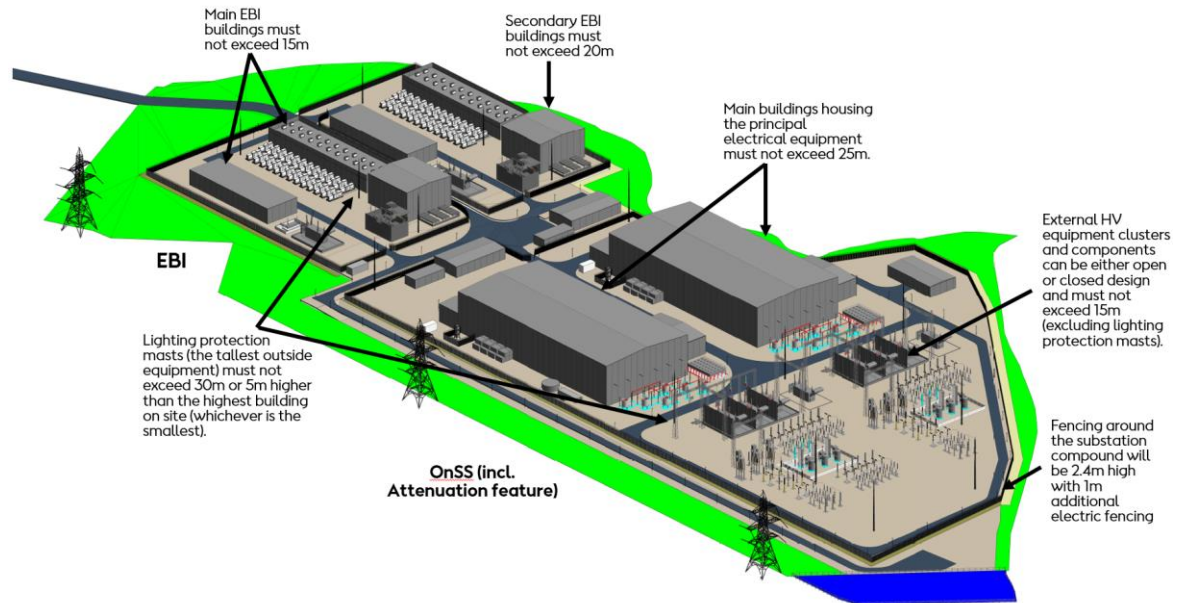
6.2.1.2 Additionally, landscaped bunding of up to approximately 1.85 m high are to be included within the landscaping along the southern and south-western boundary. Further details are provided in Volume **F2, Chapter 8: Outline Landscape Management Plan**.

### 6.3 Building and equipment scale – DCO Requirement 7(1)(a) and 7(1)(b)

6.3.1.1 **Figure 2** and **Figure 3** present indicative layouts for both HVAC and HVDC OnSS options and identify all of the main OnSS and EBI components including their dimensions, based on the maximum design scenario in **Table 3** (further information on the maximum design parameters is provided in **Volume A1, Chapter 4: Project Description**).



**Figure 2: HVAC OnSS and EBI Annotated Indicative Layout Scale (all heights identified are maximum design parameters).**



**Figure 3: HVDC OnSS and EBI Annotated Indicative Layout and Scale (all heights identified are maximum design parameters).**

**Table 3: OnSS and EBI Maximum Parameters.**

Parameter	No	L (m)	W (m)	H (m)
<i>OnSS</i>				
Main buildings	2	240 (combined)*	80 (combined)*	25 (HVDC) 20 (HVAC)
Height of fire walls (m)	N/A	N/A	N/A	25 (HVDC) 20 (HVAC)
Secondary building	15	Area <sub>MAX.</sub> = 7,000m <sup>2</sup>		15
HV equipment clusters & components	45	N/A	N/A	15
Lightning protection height (m)	N/A	N/A	N/A	30 (HVDC) 25 (HVAC)
<i>EBI</i>				
Main buildings	4	100	25	15
Height of fire walls (m)	N/A	N/A	N/A	25
Secondary building type one	4	40	40	20
Secondary buildings type two	6	14	10	10
Lightning protection height (m)	N/A	N/A	N/A	+5m to highest building

\* The length of multiple buildings would not be longer than 120m



## 6.4 Site Layout – DCO Requirement 7(1)(a)

6.4.1.1 The OnSS and EBI layout and equipment organisation must be set out in sequential order as do all electrical transmission systems. Reorganisation of these components would require a significant increase in OnSS Footprint, in addition to a large increase in connections, cables and complexity. For this reason, only the standard transmission system layout will be considered. Every effort will be made to use space as efficiently as possible.

6.4.1.2 Indicative OnSS and EBI layouts are provided for HVDC (Figure 4) and HVAC (Figure 5) below.

### Building Form

6.4.1.3 Building form for both the OnSS and EBI is anticipated to be 'cube' shaped, with a two-sided sloping roof. This type of building form is a functional form that doesn't jar with the surrounding vernacular. This simple building form is also prominent throughout the Creyke Beck Substation Site. The roofline should be designed to strengthen the linkages to surrounding agricultural structures where possible.

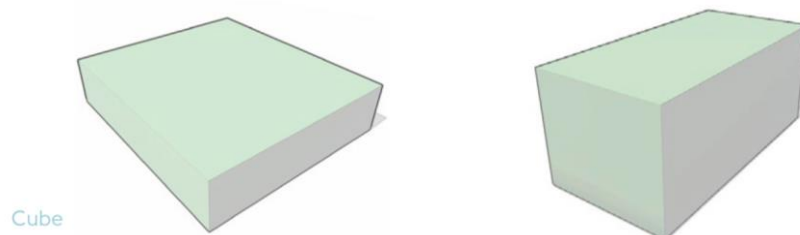




Figure 4: Indicative HVDC OnSS and EBI Layout.



## 6.5 Operational Noise Mitigation – DCO Requirement 7(1)(i)

6.5.1.1 The Noise and Vibration assessment undertaken for the OnSS identified the need for noise mitigation, to accord with satisfactory noise levels at surrounding noise sensitive receptors (residential properties) (see [Volume A3, Chapter 8: Noise and Vibration](#) and [Volume A4, Annex 5.1: Impacts Register](#) for details). This resulted in the addition of 1(i) in Requirement 7 of the DCO (see [Section 2](#)) and Co159 which states the “Operational noise from the onshore substation will be at a noise level no greater than 5dB above the representative background (LA90,T) during the day time and night at the identified noise Sensitive Receptors, as stated within the onshore noise assessment (document reference A3.8)”. As such, the OnSS will comply with the relevant rules and regulation in relation to noise. Preliminary assessment indicates that currently available equipment and technology may accommodate a substation design without specific noise mitigation, through the selection of specific equipment to reduce noise levels at source. However, this cannot be finally determined until the detailed design has been completed (to inform the final Design Plan), and all equipment has been selected and georeferenced. Hornsea Four’s approach to noise mitigation follows the following hierarchy:

1. Select low noise equipment, to reduce noise at the source;
2. Tailor the detailed design layout to shield the surroundings from the noise;
3. Use local noise barriers in form of fences and/or mounds; and
4. Noise enclosures for the equipment.

6.5.1.2 Details of the identified necessary noise mitigation measure (both engineered design measures, and additional noise mitigation measures if required) will be included in the final Design Plan.

## 7 External Appearance and materials – DCO Requirement 7(1)(d)

7.1.1.1 This section describes the envelope of external appearance and materials that will be considered during the OnSS detailed design.

7.1.1.2 All buildings and external surfaces shall be designed and constructed to suit its specific purpose with due consideration of health and safety, noise mitigation, maintenance and lifecycle consideration, and aesthetics.

### 7.2 External Building Materials

7.2.1.1 The choice of material for the proposed buildings serves a functional and structural requirement. As such, the choice of materials to be used will be dictated by the functional requirements of the OnSS and EBI. It is anticipated that building materials are likely to comprise corrugated metal sheeting, which has the following benefits:

- Robust, cost effective and generally low maintenance;
- Corrugated form prominent in rural setting;
- Flexible in terms of colour choice; and
- Not flammable and readily available.

7.2.1.2 Other material options may be considered during detail design, subject to satisfying functional and structural requirements. The Detailed Design Plan shall include final details of the selected materials.

### **7.3 External Building Finishes and Application of Colour**

7.3.1.1 Whilst the technical and functional requirements of the OnSS and EBI limit several design considerations, there is an opportunity to consider the application of colour on the facades of buildings.

#### Colour Selection

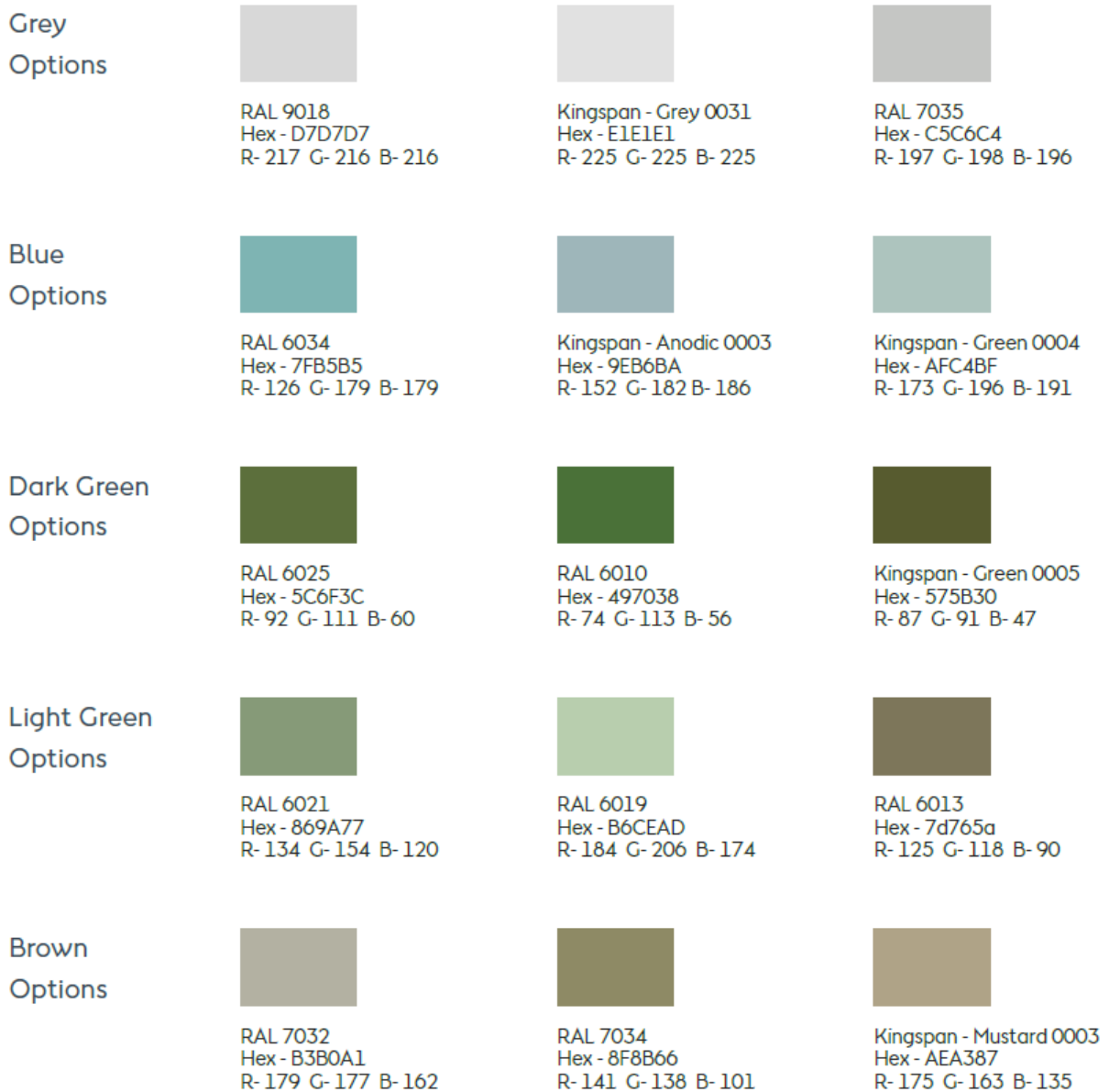
7.3.1.2 A colour sampling exercise was undertaken to determine the most prominent colours within the local landscape. This has been used to inform the colour palette of the OnSS built form and will also influence signage and hard landscape materials where feasible. Using colours with a strong local context will help integrate the development into the landscape. Colours have been influenced by dominant local features including infrastructure/cloud cover, skylines, agriculture and geomorphology.

7.3.1.3 Given the rural context of the OnSS site, bright, bold colours are not suited for this development since muted shades would create a 'quieter' appearance and soften the visual appearance of the development. Subject to the direction and topography of the viewpoint, lighter shades should typically be used towards the roofline as it would make the top of buildings comparatively less visible against the skyline, whilst dark brown / green tones at the lower section would blend in with the wooded horizon line throughout the seasons.

7.3.1.4 The colours cool grey, light steel blue, dark olive green and rosy brown were considered to be the most appropriate for the Hornsea Four OnSS. It is considered that the cool grey colour is the most prominent and would:

- complement existing infrastructure (pylons, wind turbines and existing substation);
- compliment rather than competes with the surrounding palette of landscape colours; and
- be appropriate throughout the seasons.

7.3.1.5 The exact colours used will be reliant on manufacturer limitations. As such, the colours to be used for the OnSS and EBI will be as similar as feasibly possible as those presented in [Figure 6](#).



**Figure 6: Colour Sampling Exercise Results – indicative colour options subject to manufacturer limitations during detailed design and equipment selection.**

### Application of Colour on Buildings

7.3.1.6 The finish of the colour used on building facades will be considered to ensure that the reflectiveness of surfaces is reduced as much as is feasible.

- 7.3.1.7 The Applicant is committed to using a variation of one of the colour application designs outlined in [Figure 7](#) to [Figure 9](#), noting that the specific colours shown in the figures presented demonstrate only an indicative example of what may be used, based on the indicative OnSS and EBI layout at this time. The reason why the specific design or the colour to be applied cannot be confirmed presently is that the development of the final option selected during detailed design is subject to manufacturers' specifications, and will need to be agreed through consultation with ERYC.
- 7.3.1.8 The OnSS and EBI site will be reviewed from the north, east, south and west to determine the most appropriate colour application for each building façade. For example, an area of higher topography would potentially require greener or earthier tones to extend higher on building facades than a viewpoint from a lower topography. This could result in the dark olive green band at the base of buildings extending higher on one building façade (for example the north) than another (for example the south). Different colour application options (such as simple banding and adaptive panelling) will not be mixed across different facades – one option will be used throughout. The feasibility of this exercise is to be determined as part of the final Design Plan; there is potential for all facades to utilise identical colour application.



**Figure 7: Colour Application Indicative Option 1 – Simple Banding.**



Figure 8: Colour Application Indicative Option 2 - Multi-layer Banding.



Figure 9: Colour Application Indicative Option 3 – Adaptive Panelling.



## **7.4 Hard Surfacing Materials – DCO Requirement 7(1)(e)**

- 7.4.1.1 The hard surfacing within the OnSS and EBI plants shall be of a nature that is suitable of the operation and maintenance of the substation.
- 7.4.1.2 All permanent roads, hard standings and footpaths are anticipated to be of impervious construction, laid to falls. All other areas shall generally be capable of carrying maintenance traffic and otherwise be maintenance free. All surfacing will comply with the Specification for Highways works.
- 7.4.1.3 Substation surfacing shall be capable of trafficking by plant having individual wheel loads up to 5 tonnes. The materials to be used will be determined during detailed design.

## **8 Access, parking and circulation – DCO Requirement 7(1)(f)**

- 8.1.1.1 The layouts of the OnSS shall ensure that there is acceptable access for fire and rescue service vehicles to buildings and large oil filled plant service and fire hydrants, or static water tanks if provided. The OnSS will be designed such that in the event of one direct escape route being obstructed an alternative pedestrian route is easily accessible.
- 8.1.1.2 Access to service / drainage section of the OnSS should be provided (whenever possible) without having to enter the OnSS and / or EBI fenced areas.
- 8.1.1.3 The access roads shall be designed in accordance with BS/EN 13108-1.
- 8.1.1.4 The location and size of on-site parking facilities will be agreed during the detailed design process.

## **9 Minor Structures – DCO Requirement 7(1)(g)**

### **9.1 Security Fencing**

- 9.1.1.1 It is noted that detail regarding fencing will be approved under DCO Requirement 12. Outline information is provided in this Outline Design Plan for DCO application purposes only and will not form part of the detailed Design Plan to be submitted under DCO Requirement 7.
- 9.1.1.2 The security fence around the perimeter of the substation shall comply with National Grid Technical Standard 2.22.
- 9.1.1.3 The external substation perimeter security (fencing and gates) shall, as a minimum, be a Category 2 'Standard' fence system". This is defined as a 2.4 m high fence that can be either physical mesh or palisade barrier with electric pulse fence.
- 9.1.1.4 Whilst palisade fence has traditionally been the preferred choice for substation fence construction, further investigation will be carried out during detailed design in order to consider the use of steel mesh panel fencing.

## 9.2 Screen Options

- 9.2.1.1 It is noted that detail regarding fencing will be approved under DCO Requirement 12. Outline information is provided in this Outline Design Plan for DCO application purposes only and will not form part of the detailed Design Plan to be submitted under DCO Requirement 7.
- 9.2.1.2 The use of screens will be explored during detailed design for areas on the perimeter of the OnSS and EBI site where footfall of pedestrians is anticipated (such as near to the diverted public right of way (PRoW)). The benefits of screens to block the view of the OnSS and EBI will be considered during detailed design and weighed up against the use of natural screening (which will be prioritised, such as hedgerows). If used, an industrial, utilitarian aesthetic should be avoided as this does not reflect the rural setting of the OnSS. Screens should instead seek to use materials that reflect the local landscape such as timber. Colour could be applied to reduce the visual impact particularly along vegetated boundaries. Any screens would need to be located outside of the security fencing.



Img 27 - Painted horizontal timber



Img 28 - Timber acoustic fencing

## 9.3 Refuse

- 9.3.1.1 As the substation is unmanned, no refuse is anticipated at the OnSS or EBI during operation.
- 9.3.1.2 Toilets will be via septic tank or connection to public sewer if there is one available in the vicinity of the site.

## 9.4 Signage

9.4.1.1 Internal signage within the OnSS and EBI site will typically comprise internal safety signage. The design characteristics of this signage is to be determined based on technical requirements.

9.4.1.2 External signage (outside the perimeter fencing of the OnSS and EBI) will to the extent possible use colour and materials informed by the local landscape, and will, where feasible, provide a consistent design theme throughout all signage provided (both technical requirements outlined in this document, and information boards and PRow diversion signage outlined in [Volume F2, Chapter 14: Outline Enhancement Strategy](#)).

## 9.5 Lighting

9.5.1.1 Lighting at the Hornsea Four OnSS site should:

- comply with Co193 (see [Table 1](#));
- only operate when required and will be directed inwards (notably lighting around the northern edge of the OnSS) in order to provide a minimum 10 m 'dark corridor' within existing vegetation (see [Volume F2, Chapter 3: Outline Ecological Management Plan](#) for further details);
- maintain unlit areas where there is existing vegetation for ecological reasons,
- fulfil the operational requirements at night-time (minimal light levels that permits and guidelines allow);
- light only essential areas such as key routes and building entrances;
- produce minimal levels of overspill into the surrounding countryside and avoid unnecessary illumination within the site;
- incorporate 'dark periods', through the use of either motion sensitive or time limited lighting;
- ensure that permanent lighting is reserved for essential areas only;
- avoid the use of reflective surfaces under lighting;
- incorporate the use of narrow spectrum bulbs, avoiding white and blue wavelengths of the light spectrum;
- avoid the use of cool light and instead use warm white LED to minimise visual impacts;
- provide a safe environment for users;
- be integrated with the existing infrastructure and avoid the use of additional columns and visual clutter; and
- light wayfinding and signage to aid orientation at night.

9.5.1.2 The above list doesn't constitute an exhaustive list of the requirements; however, it provides an outline summary of the considerations to inform the detailed Design plan (under Requirement 7 of the DCO).

## 10 References

National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-1, Department for Environment and Climate Change (DECC), 2011)

British Standards Institution, (2016). Bituminous mixtures. Material specifications. Asphalt Concrete. BS/EN 13108-1. London: British Standards Publications.

National Grid (2013). Technical Specifications - Perimeter Security Fencing for Substations and Other Operational Compounds Perimeter Security Fencing for Substations and Other Operational Compounds. NG TS 2.22.