



# Beatrice Offshore Wind Farm Consent Plan

## Design Statement

November 2015

  
**Beatrice**  
Offshore Windfarm Ltd

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|                          |                             |
|--------------------------|-----------------------------|
| Project Title/ Location  | Beatrice Offshore Wind Farm |
| Project Reference Number | LF0000005                   |
| Date:                    | November 2015               |

# Beatrice Offshore Wind Farm Design Statement

Pursuant to 36 Consent Condition 14 and Marine Licence (Offshore  
Transmission Works) Condition 3.2.2.7

For approval of the Scottish Ministers

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| Rev | Prepared By                       | Sign Off     | Checked By | Sign Off         | Approved By                    | Sign Off   | Date of Issue                 |
|-----|-----------------------------------|--------------|------------|------------------|--------------------------------|------------|-------------------------------|
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## **Consent Plan Overview**

### **Purpose of the Plan**

This Design Statement (DS) has been prepared to address the specific requirements of the relevant conditions attached to Section 36 Consent and Marine Licences issued to Beatrice Offshore Windfarm Limited (BOWL).

The DS presents visualisations of the final Development, as set out for approval in the Development Specification and Layout Plan (DSLPL).

### **Scope of the Plan**

The DS presents, in line with the requirements of Section 36 and Marine Licence conditions and the outcome of consultation on the scope of the DS, the following:

- A comparison of Zone of Theoretical Visibility of the consented project against the final Development.
- Visualisations of the final Development from a number of agreed viewpoints along the coastline.

### **Structure of the Plan**

The DS is structured as follows:

Sections 1 to 4 set out the scope and objectives of the DS, provide an overview of the Project, set out broad statements of compliance and detail the process for making updates and amendments to this document.

Section 5 sets out the guidance applied in completing this DS and the consultations completed in agreeing the selected viewpoints for visualisations.

Section 6 introduces and interprets the Zone of Theoretical Visibility maps prepared in support of the DS and compares these against the consented layout.

Section 7 sets out the visualisations and viewpoint design appraisal.

Section 8 confirms that the final Development design, as considered in this DS, complies with that described and assessed in the original Application.

Appendices demonstrate compliance with the original Application and present supporting figures and visualisations.

### **Plan Audience**

The DS is submitted to the Scottish Ministers for approval and to the Highland Council, the Moray Council, Scottish Natural Heritage and the Joint Nature Conservation Committee for information only.

**Plan Locations**

Copies of this DS are to be held in the following location:

- BOWL Head Office.

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### List of Abbreviations and Definitions

| Term                | Definition  |
|---------------------|---|
| Application         | The application letters and Environmental Statement submitted to the Scottish Ministers by BOWL on 23 April 2012 and Supplementary Environmental Information Statement submitted to the Scottish Ministers by BOWL on 29 May 2013.  |
| BOWL                | Beatrice Offshore Windfarm Limited (Company Number SC350248) and having its registered office at Inveralmond House, 200 Dunkeld Road, Perth, PH1 3AQ.   |
| Development         | The Wind Farm and the OfTW.   |
| DS                  | Design Statement as required for approval under Condition 14 of the S36 Consent and Condition 3.2.2.7 of the OfTW Marine Licence.   |
| DSL P               | Development Specification and Layout Plan as required for approval under Condition 13 of the S36 Consent and Condition 3.2.2.6 of the OfTW Marine Licence.  |
| ES                  | The Environmental Statement submitted to the Scottish Ministers by the Company on 23 April 2012 as part of the Application as defined above.  |
| JNCC                | Joint Nature Conservation Committee.  |
| LAT                 | Lowest Astronomical Tide.   |
| Licensing Authority | The Scottish Ministers.   |
| Marine Licences     | The written consents granted by the Scottish Ministers under Section 20(1) of the Marine (Scotland) Act 2010, which were issued on 2nd September 2014.  |
| MS - LOT            | Marine Scotland Licensing Operations Team.  |
| MW                  | Megawatts.  |
| OfTW                | The Offshore Transmission Works. The OfTW includes the transmission cable required to connect the Wind Farm to the Onshore Transmission Works. This covers the Offshore Transformer Modules (OTMs) and the cable route from the OTMs to Mean High Water Springs (MHWS) at the landfall west of Portgordon on the Moray coast. |
| OSP                 | Offshore Substation Platform.   |
| OTM                 | Offshore Transformer Module means an alternating current (AC) OSP which is a standalone modular unit that utilises the same substructure and foundation design as a wind turbine generator.   |
| Photomontage        | A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs.   |
| RWCS                | Realistic Worst Case Scenario as assessed in Section 14: SLVIA of the Beatrice Offshore Wind Farm ES i.e. 142 x 7MW turbines  |

| <b>Term</b> | <b>Definition</b>  |
|-------------|--|
|             | with a blade tip height of 198.4m.   |
| Site        | The area outlined in red in Figure 1 attached to the (S36) Consent Annex 1 and the area outlined in red and the area outlined in black in the figure contained in Part 4 of the (OfTW) Marine Licence.   |
| SEIS        | Supplementary Environmental Information Statement submitted to the Scottish Ministers by the Company on 29 May 2013 as part of the Application.  |
| SLVIA       | Seascape, Landscape and Visual Impact Assessment incorporated into the submitted ES. A tool used to identify and assess the likely significance of the effects of change resulting from development both on the seascape and landscape as an environmental resource in its own right and on people's views and visual amenity. |
| SNH         | Scottish Natural Heritage.   |
| THC         | The Highland Council.  |
| TMC         | The Moray Council.   |
| Wind Farm   | The offshore array development as assessed in the ES including wind turbines, their foundations, inter-array cabling and meteorological masts.   |
| Wireframe   | A digitally produced wireline model of a development that can be presented on its own or sized and placed over a photograph or series of photographs to enable the generation of a photomontage.   |
| Works       | The Wind Farm or Offshore Transmission Works (the OfTW), as described in the relevant Marine Licence.  |
| WTG         | Wind Turbine Generator.  |
| ZTV         | Zone of Theoretical Visibility. A map, usually digitally produced, showing areas of land and sea from within which a development is theoretically visible.   |

## 1 Introduction

### 1.1 Background

1.1.1 The Beatrice Offshore Wind Farm received consent under Section 36 of the Electricity Act 1989 from the Scottish Ministers on 19 March 2014 (the S36 Consent) and was issued two Marine Licences from the Scottish Ministers, for the Wind Farm and associated Offshore Transmission Works (OfTW) on 2 September 2014 (the Marine Licences). The Wind Farm and the OfTW are jointly referred to as the 'Development'.

### 1.2 Objectives of this Document

1.2.1 The S36 Consent and Marine Licences contain a variety of conditions that must be discharged through approval by the Scottish Ministers/Licensing Authority prior to the commencement of any offshore construction works. One such requirement is the submission of a Design Statement (DS) which is required to provide visualisations of the Development from key viewpoints.

1.2.2 The relevant conditions setting out the requirement for a DS, and which are to be discharged by this DS, are presented in full in Table 1.1. Note that the DS is to be provided, for information only, to The Highland Council (THC), the Moray Council (TMC), Scottish Natural Heritage (SNH), and the Joint Nature Conservation Committee (JNCC).

1.2.3 This document is intended to satisfy the requirements of the S36 Consent and Marine Licence (OfTW) conditions by providing a DS that presents visualisations from viewpoints agreed with the Scottish Ministers of the Development as described in the Development Specification and Layout Plan (DSLPL) which is submitted separately for approval. The DSLP confirms the final layout and specification of the Development.

**Table 1.1 – DS consent conditions to be discharged by this document**

| Ref.                                     | Condition Text   | Where Addressed   |
|--|--|---|
| Section 36<br>Consent<br>Condition<br>14 | The Company must, prior to the Commencement of the [Wind Farm], submit a Design Statement ("DS"), in writing, to the Scottish Ministers  | This document sets out the DS for submission to the Scottish Ministers. |
|  | that includes representative wind farm visualisations from key viewpoints agreed with the Scottish Ministers, based upon the final DSLP as approved by the Scottish Ministers (as updated and amended from time to time by the Company). | Section 5.4 (agreement of viewpoints)<br>Appendix D - Visualisations    |
|  | The DS must be provided, for information only, to the Planning Authorities, and the JNCC, SNH and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers.                               | To be undertaken by BOWL.   |
|  | The DS must be prepared and signed off by at least one qualified landscape architect, instructed by the Company prior to submission to the Scottish Ministers.   | Section 5.2 (DS preparation)  |

| Ref.                                  | Condition Text   | Where Addressed  |
|---------------------------------------|--|--|
| OfTW Marine Licence Condition 3.2.2.7 | The Licensee must, prior to the Commencement of the [OfTW], submit a DS, in writing, to the Licensing Authority  | This document sets out the DS for submission to the Licensing Authority. |
|                                       | that includes representative visualisations from key viewpoints agreed with the Licensing Authority, based upon the DSLP, as approved by the Licensing Authority (as updated and amended from time to time by the Licensee). | Section 5.4 (agreement of viewpoints)<br>Appendix D - Visualisations     |
|                                       | The DS must be provided, for information only, to the Highland Council and Moray Council and the JNCC, SNH and any such other advisors or organisations as may be required at the discretion of the Licensing Authority.     | To be undertaken by BOWL.  |
|                                       | The DS must be prepared and signed off by at least one qualified landscape architect, instructed by the Licensee prior to submission to the Licensing Authority.   | Section 5.2 (DS preparation)   |

### 1.3 Linkages with other Consent Plans

- 1.3.1 Condition 14 of the S36 Consent and Condition 3.2.2.7 of the OfTW Marine Licence (see Table 1.1 above) requires this DS to be based upon the information presented in the DSLP, prepared for approval in response to S36 Consent Condition 13 and OfTW Marine Licence Condition 3.2.2.6. The DSLP details the final specification and layout of the Development that BOWL will construct.

### 1.4 Structure of this DS

- 1.4.1 In response to the specific requirements of the S36 Consent and the OfTW Marine Licence conditions, this DS has been structured so as to be clear that each part of the specific requirements has been met and that the relevant information requested by the Scottish Ministers has been provided. The document structure is set out in Table 1.2.

**Table 1.2 – DS document structure**

| <b>Section</b> | <b>Title</b>                                  | <b>Overview</b>  |
|----------------|---|--|
| 1              | Introduction                                  | Background to consent requirements and overview of the DS scope and structure; and Identifies those other consent plans relevant to the preparation of the DS. |
| 2              | Project Overview                              | Provides an overview of the project.   |
| 3              | BOWL Statements of Compliance                 | Sets out the BOWL statements of general compliance in relation to the DS consent conditions.   |
| 4              | Updates and Amendments to this DS             | Sets out the procedures for any required updating or amending the DS and subsequent further submission to the Scottish Ministers.                              |
| 5              | Design Statement                              | Sets out the approach to developing the DS including guidance used and consultation on and agreement of viewpoints.  |
| 6              | Zone of Theoretical Visibility                | Sets out the ZTVs comparing the consented development with the project described in the DSLP.  |
| 7              | Visualisations and Viewpoint Design Appraisal | Sets out an assessment of the final Development at the agreed viewpoints.  |
| 8              | Compliance with the Application, ES and SEIS  | Sets out confirmation that the details set out in this DS are in accordance with those assessed in the ES.   |
| Appendix A     | ES and SEIS Compliance                        | Table summarising the key parameters of the development as assessed in the ES compared with the Development as described in the DSLP.                          |
| Appendix B     | Photomontage Methodology                      | Sets out the photomontage methodology used.  |
| Appendix C     | Figures                                       | A series of figures, including Zone of Theoretical Visibility maps, which support the DS.  |
| Appendix D     | Visualisations                                | A series of visualisations that support the DS.  |

## **2 Project Overview**

### **2.1 Introduction**

2.1.1 This section provides a brief overview of the Development.

### **2.2 Development Overview and Layout**

2.2.1 The Development is at its closest point 13.5km from the Caithness coastline, and approximately 25km from Wick.

2.2.2 The Development will consist of the following main components:

- A total generating capacity of 588MW;
- 84 wind turbines of 7MW rated generating capacity;
- Jacket substructures each installed on four pile foundations driven into the seabed;
- Two AC substation platforms, referred to as offshore transformer modules (OTMs) to collect the generated electricity and transform the electricity from 33kV to 220kV for transmission to shore;
- A network of circa 170 to 190km of inter-array, buried or (if burying is not possible) mechanically protected, subsea cables to connect strings of turbines together and to connect the turbines to the OTMs;
- 2 buried or (if burying is not possible) mechanically protected, subsea export cables, totalling circa 130km in length, to transmit the electricity from the OTMs to the land fall at Portgordon and connecting to the onshore buried export cables for transmission to the onshore substation at Blackhillock and connection to the National Grid network; and
- Minor ancillary works such as the potential deployment of met buoys and permanent navigational marks.

2.2.3 Figure 2.1 shows the layout of wind turbines and OTMs across the Wind Farm site. Further information on the layout of the Wind Farm, including the location coordinates of each structure, is provided in the DSLP. Note that the Wind Farm includes two spare locations. These spare locations would only be utilised in the event of difficulties being encountered during the foundation installation operations at one of the wind turbine or OTM locations that could not be otherwise overcome by micro-siting.



### **3 BOWL Statements of Compliance**

#### **3.1 Introduction**

- 3.1.1 This section is intended to re-affirm the BOWL commitment to ensuring that the Development is constructed in such a manner as to meet the relevant legislative requirements set out by the S36 Consent and Marine Licences.

#### **3.2 Statements of Compliance**

- 3.2.1 BOWL in undertaking the final design and construction of the Development will require compliance with the DSLP (as approved by the Scottish Ministers) upon which this DS is based (and as updated or amended from time to time following the procedure set out in the DSLP).
- 3.2.2 Where updates or amendments are required to the project design as set out in the DSLP, BOWL will ensure the Scottish Ministers are informed as soon as reasonably practicable and where necessary this DS will be updated or amended accordingly (see Section 4 below).
- 3.2.3 BOWL in undertaking the construction and operation of the project will require compliance with other, relevant Consent Plans as approved by the Scottish Ministers.
- 3.2.4 BOWL in undertaking the construction of the project will require compliance with the limits defined by the original Application and the project description defined in the Environmental Statement (ES) and Supplementary Environmental Information Statement (SEIS) and referred to in Annex 1 of the S36 Consent in so far as they apply to this DS (unless otherwise approved in advance by the Scottish Ministers) (see Section 8).
- 3.2.5 BOWL will, in undertaking the design and construction of the Development, require compliance with the approved DSLP (and all other relevant, approved Consent Plans) by the Key Contractors and Subcontractors through condition of contract and by an appropriate auditing process.

#### 4 Updates and Amendments to this DS

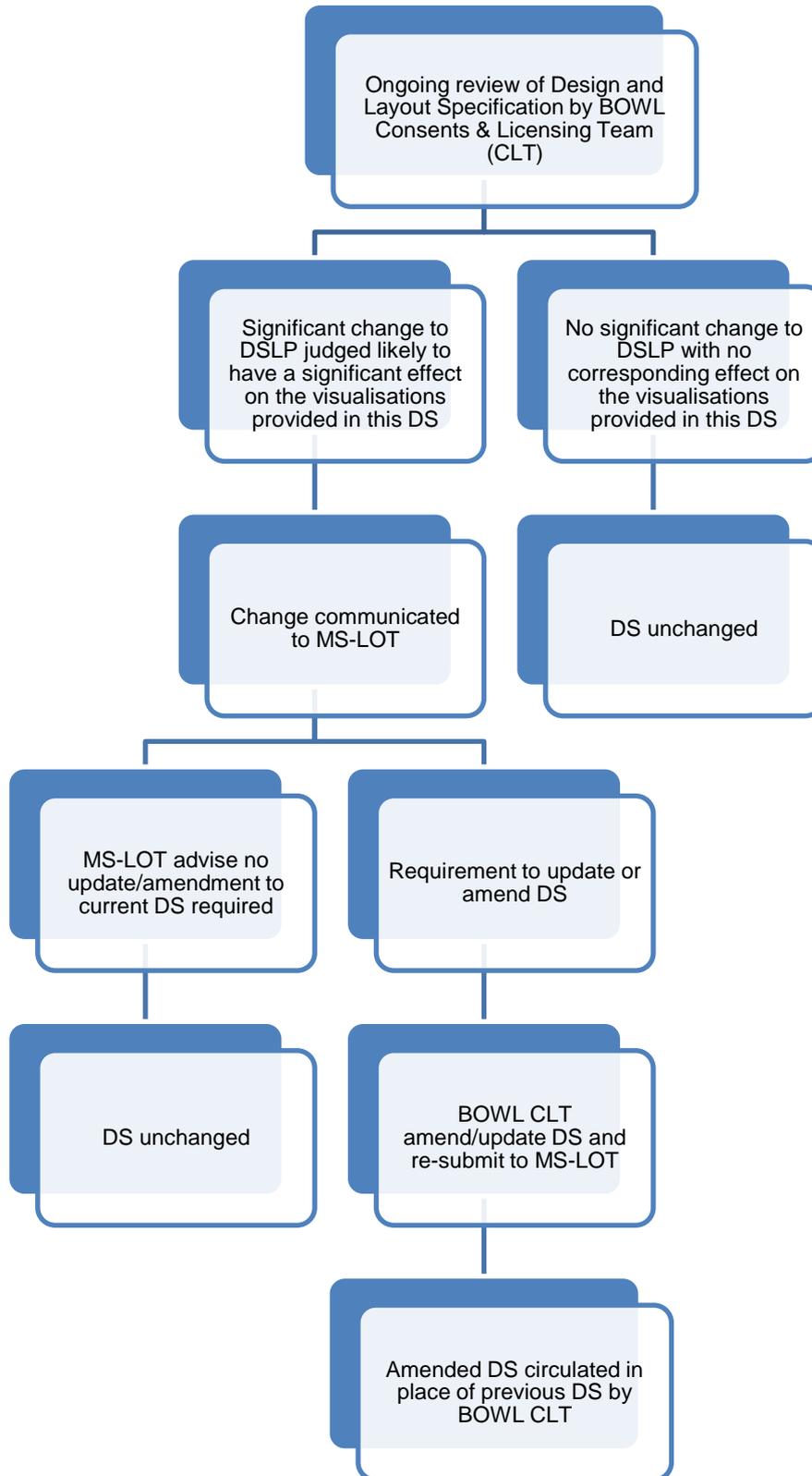
4.1.1 This DS sets out visualisations and ZTVs based on the proposed design and layout specification for the Wind Farm and offshore transmission components of the Wind Farm and OTMs as described in the DSLP.

4.1.2 The S36 Consent condition recognises that updates or amendments to this DS may be required, stating that:

*The Company must, prior to the Commencement of the [Wind Farm], submit a Design Statement ("DS"), in writing, to the Scottish Ministers that includes representative wind farm visualisations from key viewpoints agreed with the Scottish Ministers, based upon the final DSLP as approved by the Scottish Ministers (**as updated and amended from time to time by the Company**).*

4.1.3 The main design and layout specifications for both the Wind Farm and OTMs are described in the DSLP and are represented in the visualisations set out in this DS. Where it is necessary to update the design parameters in the DSLP in light of any significant new information related to the design and layout specification, and where those changes are judged likely to have a significant effect on the visualisations set out in this DS, BOWL proposes to use the change management process set out in Figure 4.1 in updating this DS, communicating such change to the Scottish Ministers, re-drafting the DS, and re-submitting the plan to the Scottish Ministers.

**Figure 4.1- DS change management procedure**



## 5 Design Statement

### 5.1 Introduction

- 5.1.1 The following sections describe the scope of this DS, as defined through consultation and adherence to relevant guidance on visual assessment.

### 5.2 Design Statement Preparation

- 5.2.1 In line with the requirement of the S36 Consent and the OfTW Marine Licence conditions, this DS has been prepared by LDA Design, an environmental planning and design consultancy with extensive experience in seascape, landscape and visual impact assessment. This DS has been approved by Mr William Wheeler, a Director at LDA Design and a qualified landscape architect with 20 years' experience in seascape, landscape and visual impact assessment. The DS focuses on the visible marine based elements of the scheme with the subsea works having been scoped out.

### 5.3 Guidance Documents

- 5.3.1 No guidance exists specifically on the production of a Design Statement for a consented offshore wind farm, but relevant elements of existing guidance documents on the visual effects of wind farms published by SNH have been referenced in developing the scope of this DS and in accordance with the requirements of the relevant consent conditions set out in Table 1.1.
- 5.3.2 By agreement with Marine Scotland, The Highland Council and SNH, visualisation material supporting this DS has been prepared in accordance with the guidance provided in relation to onshore wind farm schemes set out in '*Visualisation Standards for Wind Energy Developments*' (The Highland Council, March 2015) (referred to as the 'Standards'). In addition, two Zone of Theoretical Visibility (ZTV) figures have been included within the DS and these have been prepared in accordance with SNH's '*Visual Representation of Wind Farms, Version 2.1*' (Scottish Natural Heritage, December 2014).
- 5.3.3 The guidance document '*Siting and Designing Wind Farms in the Landscape*', version 2 (SNH, May 2014) provides guidance on the siting and design of onshore wind farms. The document cross references to various other SNH guidance documents and, under paragraph 1.6 states '*For offshore wind farms reference should be made to Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape (SNH, 2012)*'.

5.3.4 Whilst ‘*Siting and Designing Wind Farms in the Landscape*’ is focused on the onshore environment it is noted that many of the design criteria that it identifies have some level of applicability to a marine setting where matters such as (seascape) character, scale (of development), size (of turbines and development), proportion, perspective, pattern (of the array), relationship with coastal landform, and focal features, may need to be considered during the design evolution of a development.

5.3.5 The guidance document ‘*Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape*’ (SNH, March 2012) provides guidance to assist with the scoping of an Environmental Statement for an offshore development and thus is focused on the pre-consenting stage of project development and therefore not used in preparation of this document.

#### 5.4 Agreement of Viewpoints

5.4.1 The S36 Consent and Marine Licence conditions set out in Table 1.1 include a requirement that the DS should provide:

*...representative wind farm visualisations from **key viewpoints agreed with the Scottish Ministers**, based upon the final DSLP...*

5.4.2 To address this requirement, consultation was initiated by BOWL in December 2014. BOWL’s letter to Marine Scotland Licensing and Operations Team (MS-LOT) of 2 December 2014 summarised the proposed approach to be taken to this DS and identified 6 proposed viewpoints for the preparation of visualisation material. All six of the proposed viewpoints were as previously presented within the ES and included the two viewpoints at Wick and Lybster which had previously been highlighted by the consultees during the original seascape, landscape and visual impact assessment (SLVIA) consultation process as particularly important locations from which the design layout should be considered.

5.4.3 All six viewpoints proposed are coastal locations at distances from the Wind Farm site boundary varying between 13.9km to 27.3km. Wireframes of the proposed layout as seen from the viewpoints at Wick and Dunbeath accompanied the consultation letter. The letter also identified a relevant update in SNH visualisation guidance.

5.4.4 Marine Scotland responded to the consultation approach on 1 May 2015 confirming the following:

- TMC had no comments or objections to the proposed viewpoints.
- THC had no objections to the proposed viewpoints but with a request that Duncansby Head also be included and a requirement that all visualisations be presented to The Highland Council’s Standards.
- SNH agreed to the six proposed viewpoints and confirmed that as all visualisations would have to be produced to THC’s Standards, SNH would not

also require visualisations to the formats set out within their own guidance.

- Marine Scotland confirmed that there were no specific requirements for the structure and content of this DS.

5.4.5 In response, BOWL confirmed that the additional viewpoint requested by THC would be included within this DS.

5.4.6 The agreed viewpoints for this DS are:

- Viewpoint 1 – Duncansby Head;
- Viewpoint 2 – Keiss Pier;
- Viewpoint 4 – Wick Bay;
- Viewpoint 5 – Sarclet;
- Viewpoint 7 – Lybster;
- Viewpoint 8 – Latheron; and
- Viewpoint 9 – Dunbeath.

5.4.7 The viewpoint numerical references are aligned with those used in the original ES since the viewpoints considered within the DS are the same as those that were used within the ES.

5.4.8 BOWL also confirmed that all visualisation material would be in accordance with the '*Visualisation Standards for Wind Energy Developments*' (The Highland Council, March 2015)

5.4.9 Subsequent to the formal response from Marine Scotland, BOWL issued a schedule setting out the visualisation material that was understood to be required in order to comply with The Highland Council's visualisation standards to The Highland Council in July 2015 to seek verification of the visualisation material required to be presented in this DS. The Highland Council verified the schedule in August 2015.

5.4.10 This DS has thus been prepared in accordance with the feedback received during consultation and is supported by a set of figures and representative Wind Farm visualisations (see Appendices C and D) for the seven key agreed viewpoints. All visualisation material is provided in hard copy form and in pdf files uploaded to CD, with the exception of the images for The Highland Council's panoramic viewer which are required by The Highland Council on CD only, consistent with the requirements of section 11 of The Highland Council Standards.

## 5.5 Schedule of Visualisation Material

5.5.1 This section provides a description of the visualisation material which accompanies this DS.

5.5.2 The following figures have been produced, see Appendix C

- Fig 1 Site and Viewpoint Location: This identifies the location of the project site boundary and the individual turbine locations of the final layout. It also shows the agreed seven viewpoint locations for which visualisation material has been prepared to inform the design appraisal. The figure has been prepared to the requirements of THC.
- Fig 2 Zone of Theoretical Visibility (ZTV) – Final and Consented Layouts – Bareground: This figure shows the turbine locations for the final layout (in blue) and those for the consented scheme (in yellow). ZTVs have been generated for both layouts and combined in a Venn diagram to illustrate the different extents of visibility. The ZTV shows that the extent of theoretical visibility of the final layout will be less than that for the consented scheme, both out at sea and from some locations onshore. The contrasted turbine locations also demonstrates that the final layout occupies a reduced marine area with a marginally narrower spread comprised of fewer and smaller turbines.
- Fig 3 Zone of Theoretical Visibility (ZTV) – Final and Consented Layouts – with Screening: This ZTV contains the same information as Figure 2 but also includes for any associated screening effects arising from key areas of woodland and urban areas.

5.5.3 Appendix D includes all the visualisation material associated with the agreed seven viewpoints (Figures 4a-e to Figures 10a-e). All the figures provided have been prepared in accordance with the requirements of THC Standards. For each viewpoint there are a set of figures provided as follows:

- Fig a: Each set of viewpoint figures includes a viewpoint location plan on a 1:25,000 Ordnance Survey base indicating the exact location of the viewpoint, the direction of view and field of view fans for cross referencing to other figures.
- Fig b: Each viewpoint also includes a panoramic photomontage which show the Wind Farm in its wider landscape and marine context.
- Fig c: This figure contains two images – the baseline photograph of the existing view along with a solid model render that includes a wireline of the Wind Farm. (The wireline includes the turbine numbering system. The specific requirements of the THC Standards have been adapted here (with the agreement of THC) given the number of turbines included within the Wind Farm and their distant clustering).
- Fig d: This figure is a single frame 50mm focal length photomontage with the Wind Farm shown in the centre of the view.
- Fig e: This figure is a 75mm focal length photomontage with the Wind Farm again shown in the centre of the view.
- Fig f: viewpoints 2, 4 and 7 include an additional monochrome analysis figure which is required by THC Standards '*Where the turbines are partially screened by landform, trees or other obstructions.*' This requires that the turbines be shown in red as a 75mm monochrome photomontage with the swept paths of the turbine blades shown as a transparent red shading. (The turbines numbering system is shown with the adaptation identified for Figure c

above).

5.5.4 Appendix B sets out the photomontage methodology used in the production of the visualisations to The Highland Council Standards as per the requirements of section 10 of the Standards.

5.5.5 The Zone of Theoretical Visibility (ZTV) figures and visualisations have been modelled and generated using the following turbine and OTM parameters set out in the DSLP, specifically:

- Layout of 84 turbines and two OTMs;
- 186.7m turbine blade tip height above LAT;
- 109.7m turbine hub height above LAT;
- 154m rotor diameter;
- Jacket substructures with a footprint of 24m x 24m rising to 22m above LAT; and
- OTM topside height of 33m above LAT.

5.5.6 The final layout also identifies two spare locations for turbines. These locations would only be used in the event that detailed site conditions prevented one/two of the identified turbine locations from being used. In the event that one or both of the spare locations are utilised this will make a negligible alteration to the turbine arrangement and grouping such that it would make no difference to the final appearance of the Wind Farm. The total number of turbines would not exceed 84.

## **6 Zone of Theoretical Visibility (ZTV)**

### **6.1 Introduction**

- 6.1.1 ZTV figures have been prepared to enable a comparison of the turbine layout for the consented scheme as described in the ES with that for the final development design layout identified within the DSLP. The two contrasting layouts are overlain in Figures 2 and 3 in Appendix C.
- 6.1.2 Figure 2 illustrates the bareground scenario and Figure 3 includes any areas of woodland and settlements that would assist in affording some filtering and/or screening of potential visibility.
- 6.1.3 For consistency with the ES the comparison of layouts considers the DSLP layout against the realistic worst case scenario (RWCS) layout that was assessed within the ES, i.e. 142 x 7MW turbines with a blade tip height of 198.4m.

### **6.2 Comparing the DSLP Layout against the Worst Case Layout**

- 6.2.1 The ZTVs in Figures 2 and 3 in Appendix C demonstrate design benefits brought about by the DSLP layout, reflecting the approximate 40% reduction in turbine numbers, their reduced seaward horizon spread and the slight reduction in hub and blade-tip height compared to the RWCS. For both ZTVs all the areas identified in yellow would theoretically have had visibility of the consented layout but will have no prospect of visibility of the final design layout. This includes areas of the more distant seaward horizon as well as scattered inland areas, principally west of Sinclair's Bay and Wick to the northwest of the Wind Farm. In addition, views of the Wind Farm from within all areas identified in green will be of 40% fewer turbines occupying a reduced horizon line spread.
- 6.2.2 Section 7 and Appendix A provide further detail on the compliance of the final Development design with the consented design parameters.

## 7 Visualisations and Viewpoint Design Appraisal

### 7.1 Introduction

7.1.1 The following section considers the design attributes of the final Development design from the seven agreed viewpoints selected from the original 14 utilised within the ES.

7.1.2 Updated photography from that taken during the consenting stage has been taken to support the visualisations in order to comply with the requirements of 'Visualisation Standards for Wind Energy Developments' (THC, March 2015).

7.1.3 The selected visualisations that support this section of the DS are presented in Appendices C and D.

7.1.4 The attributes considered within the tables below have been drawn from the guidance '*Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape (SNH, March 2012)*' in particular chapter 5, paragraphs 5.5 and 5.6 under the sub-heading 'Characteristics of Offshore Windfarms'. These paragraphs are reproduced below for ease of reference.

7.1.5 Paragraph 5.5 states: *SNH's **Siting and Designing windfarms in the landscape** explores layout and design issues in relation to onshore windfarms. Basic design principles are relevant:*

- *Turbine form, design, size and colour,*
- *Turbine layout/array,*
- *Lighting,*
- *Turbine grouping, relationship to scale-indicators and focal points, especially when viewed in relation to land – be it an island, coastline or backdrop across a firth.*

7.1.6 Paragraph 5.6 states: *For offshore windfarms additional considerations include:*

- *How they relate to the coast, their position within a channel, or firth*
- *How the height of turbines relates to other coastal elements or features, for example power station chimneys, prominent focal hills or mountains*
- *Whether they will be backclothed by sea or land*
- *Their scale if positioned within a firth on a major searoute, or on a tourist/transport route*
- *How they relate, as a new focal feature, to their surroundings – for example, by replacing the value of existing landmarks.*
- *How they will be viewed from settlements on the coast, as well as those that enjoy an 'outer' marine backcloth.*

7.1.7 The design principles identified above are all considered within the design appraisal for each of the seven viewpoints in section 7.2 below.

## 7.2 Viewpoint Design Appraisal

### Viewpoint 1 – Duncansby Head

Distance to nearest turbine is 37.0km (refer to Figures 4a – 4e for visualisations).

|   | Design Attribute                                    | Design Appraisal   |
|---|---|--|
| 1 | Turbine form, design, size and colour               | A consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. Whilst jacket substructures are visually more complex than monopoles they are characteristic of structures located within a marine environment, and reflect those used on the two Beatrice Demonstrator turbines and oil platforms within the wider locality. Given the distance of the turbines from Duncansby Head the jacket substructures will not be discernible. |
| 2 | Turbine layout/array                                | The wind turbines will be fairly evenly distributed across a portion of the horizon and the Wind Farm will read as a single array. The northern and southernmost ends of the array have fewer turbines and are visually lighter which visually works well and the Wind Farm sits comfortably on the distant 'outer' marine horizon line when viewed from this location. The clustering of turbines is informal and there are no aspects of the arrangement that appear visually uncomfortable in that they detract from the arrangement of the turbines within its setting and draw the eye.   |
| 3 | Lighting  | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety. Given the distance to the site from this viewpoint lighting is not anticipated to be visible.  |
| 4 | Turbine grouping, scale-indicators and focal points | The turbine grouping is informal and visually comfortable. Given the distant marine location of the turbines there are minimal scale-indicators beyond the two Beatrice Demonstrator turbines which will be difficult to separately identify at this distance. The only permanent scale-indicators are the Skirza Head and   |

|    | <b>Design Attribute</b>                                | <b>Design Appraisal</b>  |
|----|--|--|
|    |  | Ness Head headlands which also draw the eye in the absence of any other focal points. The turbines, located on the distant sea horizon will visually read as being of comparable height to the Ness Head headland.   |
| 5  | Contextual relationship with coast                     | From Duncansby Head the turbines will be seen just east of south and appear to be sited within an offshore marine environment off Ness Head. The location of the site means that, from a design perspective, the turbines do not visually encroach across or behind Ness Head thus preserving its immediate setting.                     |
| 6  | Height relationship with coastal elements and features | As noted, the height of the turbines will appear comparable to Ness Head. The horizontal extent of the array works well within the marine setting and relates well to the essentially horizontal character of the coastal edge.  |
| 7  | Backclothing   | The Wind Farm will be seen against an 'outer' marine backcloth with a clear separation from Ness Head.   |
| 8  | Scale of turbines                                      | The scale of the turbines works comfortably with the coastal landform in that they do not visually compete with it. The distance of the turbines from the coastline means that they remain small elements within the available view.   |
| 9  | Relationship to surroundings                           | The 84 turbines and 2 OTMs will visually sit comfortably within a simple seascape of changing appearance under different weather and light conditions. The scale of the development is appropriate to the receiving environment where it remains a distant feature on the far horizon.   |
| 10 | Visual appearance from coastal settlements             | From Duncansby Head and any coastal dwellings and/or settlements within the vicinity the development will, when visibility permits, be seen as a new distant element on the far seaward horizon. The uniform appearance of the turbines will give the wind farm a visually cohesive character that sits comfortably within the seascape. |
| 11 | Compatibility with onshore wind farms                  | The location of the Wind Farm within a distant marine environment means that there will be no obvious design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment.  |

## Viewpoint 2 – Keiss Pier

Distance to nearest turbine is 27.8km (refer to Figures 5a – 5f for visualisations).

|   | <b>Design Attribute</b>                             | <b>Appraisal</b>  |
|---|---|---|
| 1 | Turbine form, design, size and colour               | A consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. Whilst jacket substructures are visually more complex than monopiles they are not uncharacteristic of structures set within a marine environment, reflect those used on the Beatrice Demonstrator turbines and will also be difficult to detect in views from Keiss Pier.   |
| 2 | Turbine layout/array                                | The majority of the Wind Farm will be screened from view by Ness Head which encloses Sinclair's Bay to the south. The supporting visualisations indicate that only 9 of the 84 turbines (i.e. approximately 10% of the array) will be wholly visible from this location. These turbines will be relatively evenly spaced along the distant horizon line and the visible array will have a high degree of visual permeability. Beyond Ness Head, turbine blades may be intermittently visible as they rotate although at distances in excess of 28km rotating turbine blades will be very difficult to detect even in conditions of the clearest visibility. Whilst the visualisations indicate the extent to which rotating blade tips may theoretically be visible this is judged to be highly unlikely to occur given the distances involved. |
| 3 | Lighting  | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety. Given the distance to the site from this viewpoint lighting is not anticipated to be visible.   |
| 4 | Turbine grouping, scale-indicators and focal points | The arrangement of the turbines north of Ness Head works well on account of their regular spacing and visual permeability. It is a positive attribute that the turbines will appear smaller than the height of the landform at Ness Head. Ness Head and its lighthouse do act as a focal point within seaward views towards the south, and whilst nine of the wind turbines will be seen to appear next to, albeit beyond, this focal point, it is a positive feature of the design that so few turbines  |

|    | <b>Design Attribute</b>                                | <b>Appraisal</b>   |
|----|--|--|
|    |  | are wholly visible, that the density is visually light and that the turbines, in outline, share a design trait with the visually stronger white lighthouse – both features are of a simple, vertical design and relate well to the marine environment. The suggested presence of rotating turbine blades beyond the lighthouse and Ness Head will be challenging to detect.  |
| 5  | Contextual relationship with coast                     | The site location and design means that only approximately 10% of the turbines will be wholly visible and seen in the context of Ness Head. It is a positive design feature that so few of the turbines are wholly visible next to Ness Head and that those that are arranged evenly along the horizon line such that the array remains visually permeable. The rotating blades will be challenging to detect beyond the headland. |
| 6  | Height relationship with coastal elements and features | The height of the turbines off Ness Head reads comfortably in relation to the height of the landform. The turbines also relate well to the vertical lighthouse as noted above. The turbines remain a small element within the overall available view.  |
| 7  | Backclothing   | The nine visible turbines will be seen against the 'outer' marine backcloth and in the immediate context of Ness Head. At a distance of approximately 30km turbine blades passing above the headland are not anticipated to be visible on account of the limits of visual acuity.  |
| 8  | Scale of turbines                                      | The scale of the turbines works acceptably with the coastal landform as they remain secondary in height to the headland and are clearly located at some distance beyond the headland. The relationship between the turbines and the coastline is such that they do not detract from the coastal landscape and character which is a positive design attribute.  |
| 9  | Relationship to surroundings                           | The nine visible turbines will visually sit comfortably within a marine setting off Ness Head. The scale of the development is appropriate to the receiving environment.   |
| 10 | Visual appearance from coastal settlements             | From Keiss Pier and the surrounding area the turbines will be seen as a new distant element on the seaward horizon. The uniform appearance of the turbines contributes to ensuring that the turbines will remain visually secondary to the visual strength and weight of   |

|    | <b>Design Attribute</b>               | <b>Appraisal</b>  |
|----|---------------------------------------|---|
|    |                                       | the horizontal landform that terminates at Ness Head.   |
| 11 | Compatibility with onshore wind farms | The location of the Wind Farm within a distant marine environment means that there will be no obvious design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment. |

#### **Viewpoint 4 – Wick Bay (North)**

Distance to nearest turbine is 18.7km (refer to Figures 6a– 6f for visualisations).

|   | <b>Design Attribute</b>                             | <b>Appraisal</b>   |
|---|---|--|
| 1 | Turbine form, design, size and colour               | A consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. The jacket substructures reflect those used on the two Beatrice Demonstrator turbines and will be difficult to detect in views from Wick Bay   |
| 2 | Turbine layout/array                                | The visualisations for this viewpoint show that approximately half of the wind turbines will be visible from this location with the remaining turbines being screened by South Head which encloses Wick Bay to the south. The array will be seen extending along the horizon line from behind South Head with the majority of the turbines maintaining an informal arrangement. To the north of the array the rows of turbines will become more discernible and visually broken with stretches of open horizon appearing between the final rows giving a lighter density to the array at its perimeter which is a positive design feature. |
| 3 | Lighting  | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety. Given the distance to the site from this viewpoint lighting is not anticipated to be visible.  |
| 4 | Turbine grouping, scale-indicators and focal points | The grouping of turbines is reasonably visually comfortable given the relatively even distribution of turbines along the horizon line and with the fragmentation that then occurs at the seaward end of the view. The turbines will clearly be secondary to the  |

|    | <b>Design Attribute</b>                                | <b>Appraisal</b>  |
|----|--|---|
|    |  | strong presence of South Head which draws the eye to the middle distance. Other focal points within the view include the lighthouse at the end of Wick harbour pier and industrial warehouses along the harbour front.  |
| 5  | Contextual relationship with coast                     | The visible array will very much appear secondary to South Head. Whilst both headland and turbines occupy the same field of view the distance between them will be easily understood. From a design perspective this means that the visual presence of the turbines within the view of South Head is limited. As with the previous two viewpoints the horizontal grain and character of the headland is reflected well in the horizontal spread of the turbines.      |
| 6  | Height relationship with coastal elements and features | The height of the turbines reads comfortably in relation to the height of landform at South Head, with the result that the turbines are not the most dominant feature. The horizontal spread of the turbines also relates well to the prevailing horizontal character of the headland. The array, although extending across the harbour entrance, remains a relatively small element within the overall available view albeit the turbines will be easily identified. |
| 7  | Backclothing   | The visible turbines will be seen against a marine backcloth located beyond South Head and with no landform extending across the horizon line behind them.  |
| 8  | Scale of turbines                                      | The scale, spacing and density of the turbines works comfortably with the headland and coastal landform. The relationship between the turbines and the coastline and their contrasting size and scale is a positive design attribute.   |
| 9  | Relationship to surroundings                           | Whilst the view across Wick Bay is pleasant it includes a number of features that are not particularly attractive but catch the eye. The view is of an active, working harbour front which the turbines can relate to given the greater presence of built structures around the harbour frontage. The horizontal character of the array is in keeping with underlying characteristic landscape forms.   |
| 10 | Visual appearance from coastal settlements             | From Wick Bay and the surrounding area the turbines will be seen as a new distant element on the seaward horizon. The uniform appearance of the turbines and their predominantly informal arrangement is positive.  |

|    | <b>Design Attribute</b>               | <b>Appraisal</b>  |
|----|---------------------------------------|---|
|    |                                       | Whilst the turbines will be readily seen out to sea the design of the layout and location of the site does not detract from the harbour frontage or the character of the landform.  |
| 11 | Compatibility with onshore wind farms | The location of the Wind Farm within a distant marine environment means that there will be no obvious design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment. |

### **Viewpoint 5 – Sarclet**

Distance to nearest turbine is 15.2km (refer to Figures 7a – 7e for visualisations).

|   | <b>Design Attribute</b>               | <b>Appraisal</b>   |
|---|---------------------------------------|--|
| 1 | Turbine form, design, size and colour | As noted above, a consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. Sarclet is the closest stretch of coastline to the turbines and at this distance the jacket substructures will be visible just above the horizon line. Whilst visible the substructures are proportionally a small part of each turbine and relate well to those of the Demonstrator turbines. The design of the jacket substructures has been deliberately kept simple so as to limit their visibility. |
| 2 | Turbine layout/array                  | As the visualisations indicate, the entirety of the array will be visible from this viewpoint. The turbine layout will have a greater degree of complexity with the northern and southernmost extents maintaining an informal arrangement whilst the middle section reveals the grid layout. Overall, although clearly visible, the array is balanced and visually comfortable being set within the otherwise open 'outer' marine environment and clearly separated from the coastal edge.   |
| 3 | Lighting                              | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety.  |

|    | <b>Design Attribute</b>                                | <b>Appraisal</b>  |
|----|--|---|
| 4  | Turbine grouping, scale-indicators and focal points    | The turbines visually read as one wind farm development. Aside from the two Beatrice Demonstrator turbines there are no other obvious scale comparators within the immediate vicinity of the site area. The array will become the new focal point along this stretch of coastline where it will be seen in a simple setting of large skies and wide, expansive seas. Whilst the Wind Farm will be visible it is set within a simple and large scale receiving environment which is reflected in the simple and crisp design of the turbines themselves. |
| 5  | Contextual relationship with coast                     | The array will be easily visible in its entirety in views from this viewpoint and the surrounding coastline. It follows a broad south west to north east alignment running parallel to the coastline. The turbines and two OTMs will be easily discernible. The horizontal extent of the array is sympathetic to and in keeping with the landscape grain of the coastal edge.   |
| 6  | Height relationship with coastal elements and features | Given their relative proximity to the coastline the turbines will appear their largest when seen from this location. The turbines will read as clearly being located out at sea in spite of the limited extent of sea visible from this particular location. The horizontal character of the array relates well to that of the coastal edge.  |
| 7  | Backclothing   | The Wind Farm will be set against an 'outer' marine backcloth with an expansive seaward horizon line extending either side of the Wind Farm.  |
| 8  | Scale of turbines                                      | Whilst readily visible the arrangement of the turbines and the horizontal character of the array works satisfactorily with the coastal landform.  |
| 9  | Relationship to surroundings                           | As the visualisations indicate, the array will be seen above and across a horizontal coastal edge extending along the horizon line. The principal south west to north east alignment running parallel to the coastline will be evident with the turbines set within a simple expansive seascape.  |
| 10 | Visual appearance from coastal settlements             | As above, and as the visualisations indicate, the array will be seen above and across a horizontal coastal edge extending along the horizon line. The principal south west to north east alignment running parallel to the coastline will be evident with the turbines set within   |

|    | <b>Design Attribute</b>               | <b>Appraisal</b>  |
|----|---------------------------------------|---|
|    |                                       | a simple expansive seascape.  |
| 11 | Compatibility with onshore wind farms | The location of the Wind Farm within a distant marine environment means that there will be no obvious design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment. |

### **Viewpoint 7 – Lybster (end of Main Street)**

Distance to nearest turbine is 19.4km (refer to Figures 8a–8f for visualisations).

|   | <b>Design Attribute</b>                             | <b>Appraisal</b>  |
|---|---|---|
| 1 | Turbine form, design, size and colour               | As before, a consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. At this distance from the wind farm the jacket substructure may just be discernible depending upon the prevailing atmospheric, visibility and weather characteristics.                           |
| 2 | Turbine layout/array                                | As the visualisations demonstrate the full extent of the array will be evident with all turbines visible along the horizon. The northernmost turbines will appear to 'oversail' the coastal edge. Overall the turbines layout appears informal with turbines relatively evenly spaced along the horizon line. There will be minimal visual overlapping of turbines except for in a small portion of the central section where the alignment of rows will be more evident. Overall the arrangement of turbines remains visually permeable. |
| 3 | Lighting  | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety.   |
| 4 | Turbine grouping, scale-indicators and focal points | The distribution of the turbines means that they will read as one group dispersed along the horizon line where they will appear as the only seaward feature. The settlement of Lybster provides the main scale comparator, in particular the residential dwellings, but this helps in appreciating that the turbines are located at some distance from the viewpoint and settlement   |

|    | <b>Design Attribute</b>                                | <b>Appraisal</b>  |
|----|--|---|
|    |  | and sited within a wholly marine environment  |
| 5  | Contextual relationship with coast                     | As noted above the northernmost end of the array will be seen to extend from behind the coastal edge. The horizontal character of the array again reflects the predominantly horizontal character of the coastal plateau along the Caithness coastline.   |
| 6  | Height relationship with coastal elements and features | The height of the turbines reads acceptably in relation to the height of the coastal landform and the horizontal spread of the turbines also relates well to the prevailing horizontal character of the landscape.  |
| 7  | Backclothing   | The majority of the Wind Farm will be seen set against an expansive 'outer' marine environment. The northernmost turbines will appear to 'oversail' the near coastal edge but the separation distance between the coastal edge and the Wind Farm means that they will be perceived as two distinct, and separated, elements.  |
| 8  | Scale of turbines                                      | The scale of the turbines works comfortably with the coastal landform in that, although visible, they do not compete or detract from the visual strength and character of the coastal edge and landform. The turbines remain visually secondary in scale and appearance to the coastline. The relationship between the turbines and the coastline is satisfactory from a design perspective given the contrast in scale.  |
| 9  | Relationship to surroundings                           | In design terms the array works satisfactorily with the coastal edge and landform. The turbines will be readily visible but will also be clearly perceived as being sited within an offshore marine setting that is separated from the coastal edge.  |
| 10 | Visual appearance from coastal settlements             | The array will be visible from Lybster except for when visibility is limited to less than 19km. Whilst the Wind Farm will be visible it will clearly be perceived as being located within the 'outer' marine environment and at some distance from the coastline. It will be seen as a new feature within a sector of the seascape and, whilst occupying a relatively large proportion of the northward seaward horizon line, the horizon line directly out to sea from this location and around to the south will remain free of turbines. |
| 11 | Compatibility with onshore                             | The location of the Wind Farm within a distant marine environment means that there will be no obvious   |

|  | <b>Design Attribute</b> | <b>Appraisal</b>  |
|--|-------------------------|---|
|  | wind farms              | design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment. |

### **Viewpoint 8 – Latheron (A9)**

Distance to nearest turbine is 23.0km (refer to Figures 9a – 9e for visualisations).

|   | <b>Design Attribute</b>                             | <b>Appraisal</b>   |
|---|---|--|
| 1 | Turbine form, design, size and colour               | As before, a consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. At this distance from the wind farm it may be possible to discern the jacket substructure in conditions of good visibility. The design of the jacket substructures has been deliberately kept simple so as to limit their visibility. |
| 2 | Turbine layout/array                                | As the visualisations demonstrate the full extent of the array will be evident with all turbines visible along the horizon. From this viewpoint, looking due east, the array will be visible along the horizon line just above the cliff top edge. The spread of turbines within the array is broadly even although some rows are identifiable towards the centre of the array. There is minimal overlapping of turbine columns and the overall arrangement is informal.   |
| 3 | Lighting  | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety. At a distance of over 23km from the nearest turbine lighting will be difficult to discern.   |
| 4 | Turbine grouping, scale-indicators and focal points | The distribution of turbines along the horizon line ensures that they read as a single development. There are no obvious scale comparators within the view beyond the coastal edge and no existing focal points to draw the eye. The turbine array will become a new feature within the seascape.  |
| 5 | Contextual relationship with coast                  | The turbine array will be viewed in the context of the coastal edge which has the visual effect of drawing the turbines closer to the coastline. However, the horizontal   |

|    | <b>Design Attribute</b>                                | <b>Appraisal</b>  |
|----|--|---|
|    |  | extent of the array relates well in design terms to the horizontal plateau that extends to the cliff tops.  |
| 6  | Height relationship with coastal elements and features | The height of the turbines reads comfortably in relation to the height of the coastal landform and the horizontal spread of the turbines also relates well to the landscape's prevailing horizontal character.  |
| 7  | Backclothing   | The Wind Farm will be seen against an 'outer' marine backcloth of distant sea and sky. Although 'oversailing' the coastline from this particular viewpoint there is clear separation between the distant wind farm on the horizon line and the coastal edge.  |
| 8  | Scale of turbines                                      | The scale of the turbines works comfortably with the coastal landform in that the Wind Farm remains visually secondary to the coastal edge and that its strong linear character reflects the plateaued coastal landform. The relationship between the turbines and the coastline is satisfactory from a design perspective given the contrast in scale and the legible separation distance. |
| 9  | Relationship to surroundings                           | In design terms the array works satisfactorily with the coastal edge and landform maintaining a clearly legible separation between the two features. The array will be seen along the seaward horizon line 'oversailing' the coastal plateau edge but not detracting from it.   |
| 10 | Visual appearance from coastal settlements             | The array will be visible from Latheron and will be seen as a new feature within a sector of the seascape and, whilst occupying a relatively large proportion of the northward seaward horizon line, the horizon line directly out to sea from this location and around to the south will remain free of turbines.  |
| 11 | Compatibility with onshore wind farms                  | The location of the Wind Farm within a distant marine environment means that there will be no obvious design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment.   |

### **Viewpoint 9 – Dunbeath**

Distance to nearest turbine is 25.7km (refer to Figures 10a – 10e for visualisations).

|  | <b>Design Attribute</b> | <b>Appraisal</b> |
|--|-------------------------|------------------|
|  |                         |                  |

|   | <b>Design Attribute</b>                                | <b>Appraisal</b>  |
|---|--|---|
| 1 | Turbine form, design, size and colour                  | As before, a consistent size of turbine, jacket substructure and turbine colour will be used as detailed within the DSLP. This will ensure that the design is unified and consistent within its appearance. The light grey colour for the turbines is appropriate from a design perspective and works well in changing light conditions. At this distance from the wind farm it will be difficult to discern the jacket substructure.   |
| 2 | Turbine layout/array                                   | From this elevated location the array will be almost wholly visible with the exception of a few of the most northerly of the turbines. The layout presents an informal array with a relatively even density of turbines distributed along the horizon line. The density becomes lighter towards the southernmost extent and breaks of open seaward horizon open up.   |
| 3 | Lighting   | The lighting proposals reflect the statutory marine and aviation requirements for navigational and aviation safety. At this distance, it is unlikely that any lighting associated with the array will be identifiable.  |
| 4 | Turbine grouping, scale-indicators and focal points    | The turbines will be seen to extend along the horizon line directly above the elevated plateau behind the cliff top of the coastal edge. The coastal edge will enable an appreciation of the distance between the coast and the turbines given the strong contrast in size and scale. Focal points within the view are the exposed cliff that is aligned with the end of the road, the incised vegetated valley that cuts across the view and the elevated dwellings and mature trees that sit above the incised valley. Collectively these features tend to draw the eye to the foreground and middle distance with the Wind Farm occupying the far-distant 'outer' marine horizon line. |
| 5 | Contextual relationship with coast                     | The turbine array will be viewed in the context of the coastal edge. However, the draw of seaward views is more towards the south east rather than in the direction of the turbines that extend across and above the coastal plateau ledge.   |
| 6 | Height relationship with coastal elements and features | The height of the turbines reads comfortably in relation to the height of the coastal landform and the horizontal spread of the turbines also relates well to the landscape's prevailing horizontal character.  |

|    | <b>Design Attribute</b>                    | <b>Appraisal</b>   |
|----|--|--|
| 7  | Backclothing                               | The Wind Farm, although 'oversailing' the coastal edge from this particular viewpoint will be seen on the far distant horizon line against a backcloth of 'outer' sea and wide expansive skies.  |
| 8  | Scale of turbines                          | The scale of the turbines works comfortably with the coastal landform. The relationship between the turbines and the coastline is satisfactory from a design perspective given the contrast in scale.  |
| 9  | Relationship to surroundings               | In design terms the array works satisfactorily with the coastal edge and landform. The array will be seen along the seaward horizon line 'oversailing' the coastal plateau edge.   |
| 10 | Visual appearance from coastal settlements | The array will be visible from this location and become a new element within the distant seaward view. Whilst it will occupy the northernmost sector of the seaward horizon line it will remain visually separated from the interest and focal features associated with the coastal edge. Seaward views directly out to sea and around towards the south will remain free of turbines. |
| 11 | Compatibility with onshore wind farms      | The location of the Wind Farm within a distant marine environment means that there will be no obvious design conflicts with onshore wind farms which will clearly be sited within a wholly different receiving environment.  |

### **7.3 Summary**

- 7.3.1 The final development constitutes a smaller scheme than that assessed within the ES consented scheme. The reduced site development area, the slightly smaller blade tip height and the approximate 40% reduction in turbine numbers compared to the RWCS all combine to give a development with a reduced visual envelope to that set out within the consented ES.
- 7.3.2 Given its distance from the coastline the Wind Farm will always be seen to be sited within the 'outer' marine environment, even when seen obliquely from the coastal edge. It will be viewed against a backcloth of open sea and wide expansive skies which are both able to accommodate the scale of the development proposed. The simple and clean design of the turbines relates well to a receiving environment of few defining features – essentially just sea and sky. Where the Wind Farm will be viewed in the context of the coastal edge the prevailing horizontal character of the coastal plateau edge will remain unaltered and clearly visually separate from the Wind Farm.
- 7.3.3 The Wind Farm will appear as a harmonious feature given the uniformity in turbine design. The viewpoint appraisal has indicated that from the locations considered the turbine layout remains visually comfortable with no awkward or eye-catching arrangements to detract from the uniform arrangement. Where the Wind Farm will be seen in the same field of view as the coastal edge it always remains secondary to the strength of the predominantly plateau coastal edge and cliff tops.

## 8 Compliance with the Application, ES and SEIS

### 8.1 Introduction

8.1.1 In addition to the conditions presented in Table 1.1, Condition 8 of the S36 Consent states:

*The Development [Wind Farm] must be constructed and operated in accordance with the terms of the Application and related documents, including the accompanying ES, the SEIS and Annex 1 of this letter, except in so far as amended by the terms of this section 36 consent.*

8.1.2 This Section sets out information from the ES/SEIS with regard to compliance with the Development layout assessed.

### 8.2 Compliance with the ES/SEIS

8.2.1 The ES and SEIS described a range of specification and layout options that could be applied during the construction of the Development. This took the form of a broad 'Rochdale Envelope' incorporating a variety of options. The ES and SEIS defined the likely specification and layout of the Development, based upon these broad options. Since the Development consents were awarded, the design of the Development has been substantially refined. The table in Appendix A presents the comparative key parameters between the consented and the Development as described in the DSLP.

8.2.2 The DSLP presents the final design, specification and layout of the Development. Relevant to the DS, the above sea level elements comprise 84 turbines with a blade tip height of 187m and two OTMs with a topside height of 33m above LAT. The DSLP confirms that all wind turbines will be mounted on jacket substructures which will rise to a uniform height of 22m above LAT. The height of the OTM jacket substructure will rise to 24m above LAT.

8.2.3 Figures 2 and 3 (Appendix C) identify and contrast the turbine layout of the assessed and consented scheme with that of the final design, as set out in the DSLP. A simple comparison highlights a number of design benefits arising from the refinement of Development design as well as confirming that the final Development is within the consented parameters.

8.2.4 Design benefits may be summarised as follows:

- a reduction in the number of turbines from the RWCS layout of 142 turbines to 84 turbines in the final design layout;
- a reduction in the extent of sea area occupied by turbines from 131.4km<sup>2</sup> under the consented layout to 98.9km<sup>2</sup> for the final design layout;
- a reduction in the extent of horizontal spread of turbines along the horizon line in all views from the coastline;

- a slight increase in the distance between the nearest point of landfall and the nearest turbine (from 13.94km to 14.78km); and,
- a reduction in the size and number of associated offshore infrastructure (i.e. two OTMs rather than a maximum of 3 OSPs and no met masts compared to up to 3 met masts as consented).

## **9 References**

SNH, March 2012, "Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape. Guidance for Scoping an Environmental Statement.

SNH, May 2014, "Siting and Designing Wind Farms in the Landscape, Version 2.

The Highland Council, March 2015, "Visualisation Standards for Wind Energy Developments.

### Appendix A: Comparison of relevant ES/SEIS Rochdale Envelope and current design parameters (as set out for approval in the DSLP)

| Design-related parameter                       | ES/SEIS  | DSLP   |
|--|--|--|
| Overall Wind Farm                              |  |  |
| Number of wind turbine structures              | Up to 277 (3.6MW capacity turbines)<br><br>(Realistic worst case scenario of 142 x 7MW for the SLVIA)          | 84 (7MW capacity turbines)   |
| Maximum site generating capacity               | 997.2MW  | 588MW  |
| Wind Turbine and OSP substructures             |  |  |
| Substructure type                              | Tubular jacket<br><br>Monotower  | Tubular jacket   |
| Design   | Tubular steel lattice structure with up to 4 'legs'  | Tubular steel lattice structure with 4 'legs'  |
| Dimensions                                     | Unknown – dependent on water depth and foundation type   | Base dimensions (pile to pile): 24m x 24m  |
| Wind Turbines                                  |  |  |
| Tip height range                               | 132.6m – 198.4m  | 186.7m   |
| Hub height range                               | 79m – 115.9m   | 109.7m   |
| Nacelle dimensions                             | Up to 26m x 16m x 12m  | 20.6m(l) x 9m(h) x 9.1m(w) including hub   |
| Blade clearance above Lowest Astronomical Tide | 25.4m – 33.4m  | 32.7m  |
| Maximum rotor diameter                         | 165m   | 154m   |
| Rotational speed (rpm)                         | 4.8 - 13   | 11.8 rpm at nominal rating, range 4 – 13 rpm   |
| Blade swept area                               | Up to 21,382.5m <sup>2</sup>   | 18,626.5m <sup>2</sup>   |
| Minimum spacing                                | 642m   | 945.5m (in a single case; most turbines spaced at 1170m)   |
| Finishes                                       | Colour scheme incorporating:<br><br>Wind turbines in RAL 7035 (grey)<br><br>Substructures in RAL 1004 (yellow) | Colour scheme incorporating:<br><br>Wind turbines and OTMs in RAL 7035 (grey) (with red blade hover reference marks on the rotor blades)<br><br>Substructures in RAL 1004 (yellow) |
| Offshore Substations                           |  |  |
| Type   | AC or DC OSP   | AC OTM (a form of OSP)   |

| <b>Design-related parameter</b>                 | <b>ES/SEIS</b>  | <b>DSL P</b>                 |
|---|---|------------------------------|
| Maximum number                                  | 2 AC & 1 DC   | 2 AC                         |
| Maximum dimensions                              | 115m x 55m x 42m  | 33m (l) x 17.2m (w) x 9m (h) |
| Maximum height of jacket substructure above LAT | 20m   | 24m                          |
| Available Foundation Types                      | Pin Piles (excluding pre-driven piles) (3 m pin piles)<br>Suction Piles | Pin Piles                    |
| Available Substructure Type                     | Tubular Jacket  | Tubular Jackets              |
| Met masts                                       |   |                              |
| Maximum number                                  | 3   | 0                            |

## **Appendix B: The Highland Council Photomontage Methodology**

### **Base photography processing and stitching**

Photography was taken with a Canon EOS-1Ds Mark III fitted with a EF 50mm f/1.4 USM lens mounted on a tripod.

The photography was processed from RAW files in Photoshop with lens correction applied. The frames used for the base panorama 65.5° images were then stitched in planar projection using PTGui software.

Panoramas submitted for the panoramic viewer have been stitched using PTGui in planar projection and have a horizontal field of view of 65.5° and vertical field of view of 18.2°

### **Ground, turbine and substation modelling and rendering**

OS Terrain 5 data was used to create the ground model. A model grid was created from each viewpoint location draped over a second ground model that incorporated Earth curvature and light refraction. A grid was created (resampled to 25m) for the land and sea, these grids were then imported into 3d Studio Max along with virtual cameras created in AutoCAD, which were matched to the single frames taken at the viewpoint location. 3d Studio Max was then used to render the solid model render and (with the addition of daylight settings and camera exposure settings taken from the single frames for each panorama) a render of the proposed wind farm. The turbine model and substation model were based on technical data provided by Siemens.

Weather conditions for each viewpoint were as follows:

|     |  |
|-----|--|
| VP1 | Duncansby Head - Sunny, scattered cloud, fair visibility                       |
| VP2 | Keiss Pier (nr Keiss Harbour House) - Sunny, scattered cloud, fair visibility  |
| VP4 | Wick Bay (North side) - Sunny, scattered cloud, fair visibility                |
| VP5 | Sarclat (Sarclat Haven information board) - Sunny, some cloud, fair visibility |
| VP7 | Lybster (end of Main Street) - Sunny, some cloud, fair visibility              |
| VP8 | Latheron (A9) - Sunny, scattered cloud, fair visibility                        |
| VP9 | Dunbeath (nr Heritage Centre) - Sunny, scattered cloud, fair visibility        |

### **Confirmation of key requirements**

1. The six figure turbine grid references and turbine base AOD levels are shown on each visualisation sheet.

2. All photographic images have been taken in landscape format and that the images have not been cropped in any way thus retaining the vertical and horizontal fields of view characteristic of the stated focal length in the 35mm camera format.
3. The height of the camera lens above ground level in all visualisations is 1.5m.
4. All the viewpoint locations specified by the Council have been visualised.
5. A minimum of 5-metre spot data has been used to create the 3D computer model.
6. The turbine/s shown in the photomontages have been constructed in accordance with the dimensions stated in the DS and that the dimensions of the turbine column, nacelle, and blades fully conform with manufacturer's specification related to the turbine output and nacelle height.
7. The 28mm, 50mm and the 75mm single frame images conform to the fields of view characteristic of the lenses used as shown below:

| Focal length (mm) | Horizontal field of view (degrees) | Vertical field of view (degrees) | Diagonal field of view (degrees) |
|-------------------|------------------------------------|----------------------------------|----------------------------------|
| 28                | 65.5                               | 46.4                             | 75.4                             |
| 50                | 39.6                               | 27.0                             | 46.8                             |
| 75                | 27.0                               | 18.2                             | 32.2                             |

Single frames should be viewed as follows:



The image should be viewed at a comfortable arm's length (approximately 500mm) and viewed normally with both eyes. The page should obscure any foreground not visible within

the photomontage itself. This enables the photomontage to be directly compared within the wider context of the real landscape.