

# European Offshore Wind Deployment Centre

## Construction Method Statement

ABE-ENV-DB-0014

July 2017

Prepared by:	Esther Villoria	Environment and Consents Manager		10/07/2017
	NAME	ROLE		DATE
Reviewed by:	Garry MacDonald	Construction Manager		10/07/2017
	NAME	ROLE		DATE
STATUS	DATE	REVISION	NAME	SIGNATURE

Revision	Date	Revision changes
0	20/03/2017	First issue
1	31/05/2017	Removal of Cable Landfall Option 2
2	10/07/2017	Post Consultation

## **Construction Method Statement Overview**

### **Purpose and objectives of the Plan**

This Construction Method Statement (CMS) has been prepared to address the specific requirements of the relevant condition attached to the Section 36 Consent (S.36 issued to Aberdeen Offshore Wind Farm Limited (AOWFL)).

The overall aim of this CMS is to set out the procedures for the construction of the Development.

This CMS confirms that the construction methods to be employed align with those considered in the original Application, and that construction-related mitigation measures detailed in the Application will be applied during installation.

All relevant method statements developed by contractors involved in the European Offshore Wind Deployment Centre (EOWDC) will comply with the procedures set out in this CMS.

### **Scope of the Plan**

This CMS covers, in line with the requirements of the S.36 Consent conditions, the following:

- Commencement dates;
- Working methods including the scope, frequency and hours of operations;
- Duration and Phasing Information of key elements of construction;
- Method of installation including techniques and equipment and depth of cable laying and cable landing;
- The use of Dynamic Positioning vessels and safety/guard vessels;
- Pollution prevention measures including contingency plans;
- Design Statement; and
- Confirmation that the construction methods described within this CMS align with those considered in the Environmental Statement (ES), Supplementary Environmental Information Statement (SEIS), Marine Licence, S.36 Consent and Marine Licence Application.

### **Structure of the Plan**

This CMS is structured as follows:

Sections 1 and 2 set out the scope and objectives of the CMS and set out statements of compliance.

Section 3 sets out the process for making updates and amendments to this document.

Section 4 provides an overview of the Development.

Section 5 provides the method of installation for each of the main components.

Section 6 provides detail on the commencement dates and hours of operation.

Section 7 details AOWFL, Contractor and Subcontractors Roles and Responsibilities.

Section 8 provides details on marine coordination, use of dynamic positioning/ guard vessels, construction ports and helicopter operations.

Section 9 refers to the pollution prevention measures including contingency plans.

Section 10 refers to the Design Statement.

Section 11 provides information to demonstrate compliance with the original Application, and how the mitigation proposed in the Application will be delivered.

Section 12 provides a reference list for documents cited within the Plan.

Appendix A demonstrates compliance with the original Application set out in the ES and SEIS and Appendix B details the ES and SEIS commitments relevant to this CMS.

### **Plan Audience**

This CMS is intended to be referred to by relevant personnel involved in the construction of the EOWDC, including AOWFL personnel, Contractors and Subcontractors. Compliance with this CMS will be monitored by AOWFL and reported to the Marine Scotland Licensing and Operations Team.

### **Plan Locations**

Copies of this CMS are to be held in the following locations:

- At AOWFL Head Office;
- At the premises of any agent, Contractor or Subcontractor (as appropriate) acting on behalf of AOWFL;
- At the AOWFL Marine Coordination Centre at Aberdeen Harbour; and
- With the Ecological Clerk of Works (ECoW(s)).

# TABLE OF CONTENTS

<b>List of Abbreviations and Definitions .....</b>	<b>8</b>
Defined Terms .....	8
Acronym Definitions .....	12
<b>1 Introduction .....</b>	<b>14</b>
1.1 Background .....	14
1.2 Objectives of this Document .....	15
1.3 Linkages with other Consent Plans .....	16
1.4 Structure of this CMS .....	17
<b>2 AOWFL Statements of Compliance .....</b>	<b>18</b>
2.1 Introduction .....	18
2.2 Statements of Compliance .....	18
<b>3 Updates and Amendments to this CMS .....</b>	<b>20</b>
<b>4 Development Overview .....</b>	<b>21</b>
4.1 Introduction .....	21
4.2 Development Overview .....	21
<b>5 Construction and Installation Methods .....</b>	<b>22</b>
5.1 Introduction .....	22
5.2 Landfall works .....	23
5.3 Scour Protection .....	25
5.4 Foundation Installation .....	26
5.4.1 Components to be installed .....	26
5.4.2 Delivery to the Construction Site .....	27
5.4.3 Method and Process of Installation .....	27
5.4.4 Stage F1 - Delivery of Foundations and Base Harbour Preparations .....	28
5.4.5 Stage F2 - Load Out of Foundation .....	28
5.4.6 Stage F3 - Transport of foundation from base harbour to Development Area .....	29
5.4.7 Stage F4 - Foundation Set Down onto the seabed .....	29
5.4.8 Stage F5 - Suction Operation .....	29
5.4.9 Stage F6 - Grouting Operation .....	30
5.4.10 Stage F7 - Foundation installation completion and HLV transit back to base harbour .....	31
5.5 Inter-array and Export Cable Installation .....	31
5.5.1 Components to be installed .....	31
5.5.2 Delivery to the Construction Site .....	31
5.5.3 Method and Process of Installation .....	32
5.5.4 Seabed Preparation .....	32

5.5.5	Export Cable Installation .....	32
5.5.6	Inter-array Cable Installation .....	33
5.5.7	Cable Burial depths.....	34
5.6	Wind Turbine Generator Installation.....	35
5.6.1	Components to be installed.....	35
5.6.2	Delivery to the Construction Site .....	35
5.6.3	Method and Process of Installation.....	35
5.7	Wind Farm Electrical Connection and Commissioning .....	39
<b>6</b>	<b>Commencement Dates and Duration and Phasing of Key components .....</b>	<b>40</b>
6.1	Introduction.....	40
6.2	Commencement Dates and Duration and Phasing of Key Components .....	40
6.3	Hours of Operations.....	41
<b>7</b>	<b>Contractors and Subcontractors .....</b>	<b>42</b>
7.1	Introduction.....	42
7.2	Contractors .....	43
7.2.1	Boskalis.....	43
7.2.2	MHI Vestas .....	43
7.3	Subcontractors .....	43
<b>8</b>	<b>Marine Coordination and Vessels .....</b>	<b>44</b>
8.1	Marine Coordination .....	44
8.2	Use of Dynamic Positioning and Safety/ Guard Vessels .....	44
<b>9</b>	<b>Pollution Prevention Measures (Including Contingency Plans) .....</b>	<b>45</b>
<b>10</b>	<b>Design Statement .....</b>	<b>47</b>
<b>11</b>	<b>Compliance with Application and Associated Addendum .....</b>	<b>48</b>
11.1	Introduction.....	48
11.2	Compliance with the Construction Methods Assessed in the ES/SEIS.....	48
11.3	Delivery of Construction-related Mitigation Proposed in the ES/SEIS .....	48
<b>12</b>	<b>References.....</b>	<b>49</b>
	<b>Appendix A Compliance with Rochdale Envelope Parameters.....</b>	<b>50</b>
	<b>Appendix B Compliance with ES Mitigation Measures.....</b>	<b>54</b>

## List of Figures

Figure 1 Location of the Development Area and the Offshore Export Cable Corridor. ....	14
Figure 2 CMS Change Management Procedure .....	20
Figure 3 Overview of Development Construction Process .....	23
Figure 4 Offshore Export Cables layout and Inter-array cable layout (subject to micro-siting) .....	24
Figure 5 Top view of scour protection design option with filter and armour layer .....	25
Figure 6 Suction Bucket Foundations and Jacket .....	26
Figure 7 Foundation Installation Sequence.....	27
Figure 8 Indicative Lifting Arrangement (pending confirmation of final design) .....	28
Figure 9 Indicative Suction Bucket Installation Operation .....	30
Figure 10 Offshore Export Cables Installation Sequence.....	33
Figure 11 Inter-array Cable Installation Sequence .....	34
Figure 12 WTG Installation Sequence .....	36
Figure 13 Contractor and Subcontractor Organisational Chart .....	42

## List of Tables

Table 1 Consent conditions to be discharged by the CMS	15
Table 2 CMS document structure	17
Table 3 Summary of foundation components to be deposited or installed	26
Table 4 Summary of cable components to be deposited or installed	31
Table 5 Summary of WTG components to be deposited or installed	35
Table 6 Anticipated construction programme	41

## LIST OF ABBREVIATIONS AND DEFINITIONS

### Defined Terms

Term	Definition
the 2010 Act	The Marine (Scotland) Act 2010.
Application	The Application and Environmental Statement submitted to the Scottish Ministers, by the Company on 1 <sup>st</sup> August 2011 and Supplementary Environmental Information Statement submitted to the Scottish Ministers by the Company on 6 <sup>th</sup> August 2012 for consent under section 36 of the Electricity Act 1989 and for a Marine Licence under 20(1) of the Marine (Scotland) Act 2010, for the construction and operation of the European Offshore Wind Deployment Centre (EOWDC) electricity generating station approximately 2 km off the coast of Aberdeenshire in Aberdeen Bay with a generation capacity of up to 100 MW.
Cables	Offshore Export Cables and Inter-array cables.
Cable Laying Strategy (CLS)	The Strategy to be submitted for approval under Condition 25 of the section 36 Consent.
Cable Protection Plan (CPP)	The Plan to be submitted for approval under Condition 3.2.1.7 of the Marine Licence.
Commencement of the Development	The date on which the first vessel arrives on the Site of European Offshore Wind Deployment Centre to begin construction in accordance with the section 36 Consent.
Commencement of the Works	The date on which the first vessel arrives on the Site to carry on any marine Licensable Marine Activity in connection with the construction of the Works, as defined by the Marine Licence.
Company	Aberdeen Offshore Wind Farm Limited (AOWFL). AOWFL is wholly owned by Vattenfall and has been established to develop, finance, construct, operate, maintain and decommission the European Offshore Wind Deployment Centre.
Completion of the Works	The date on which the Works have been installed or the Works have been deemed to be complete by the Licensing Authority, as defined by the Marine Licence.
Consent Plans	The plans, programmes or strategies required to be approved by the Scottish Ministers (in consultation with the appropriate stakeholders) in order to discharge conditions attached to the Offshore Consents.



Term	Definition
Construction	<p>As defined by the Section 36 Consent, (as per section 64(1) of the Electricity Act 1989, read with section 104 of the Energy Act 2004), construction is defined as follows:</p> <p>“construct”, in relation to an installation or an electric line or in relation to a generating station so far as it is to comprise renewable energy installations, includes:</p> <ul style="list-style-type: none"> <li>• placing it in or upon the bed of any waters;</li> <li>• attaching it to the bed of any waters;</li> <li>• assembling it;</li> <li>• commissioning it; and</li> <li>• installing it.</li> </ul>
Construction Method Statement (CMS)	The Statement to be submitted for approval under Condition 13 of the section 36 Consent.
Construction Noise Management Plan (CNMP)	The Management Plan to be submitted for approval under Condition 18 of the section 36 Consent.
Contractor	Any Contractor/Supplier (individual or firm) working on the project, hired by AOWFL.
Decommissioning of the Works	The removal of the Works from the seabed, demolishing or dismantling the Works.
Design Envelope (Rochdale Envelope)	Describes a number of components and all permanent and temporary works required to generate or transmit electricity to the National Grid including the wind farm and the offshore export cable.
Design Statement (DS)	The Statement to be submitted for approval under Condition 14 of the section 36 Consent.
Development	The European Offshore Wind Deployment Centre electricity generating station in Aberdeen Bay, approximately 2 km east of Blackdog, Aberdeenshire, as described in Annex 1 of the section 36 Consent.
Development Area	The area which includes the wind turbine generators, the Inter-array cables and part of the Offshore Export Cable Corridor, including any other works, as shown in Part 4 of the Marine Licence (named as Lease Boundary in the Marine Licence).
Ecological Clerk of Works (ECoW)	Ecological Clerk of Works as required under condition 3.2.1.4 of the Marine Licence. primarily, but not exclusively, for environmental liaison to establish and maintain effective communications between the Licensee, contractors, stakeholders, conservation groups and other users of the sea during the period in which licensed activities authorised under this licence are undertaken.

Term	Definition
Electricity Act	the Electricity Act 1989 (as amended).
Environmental Statement (ES)	The Statement submitted by the Company on 1 August 2011 as part of the Application.
Grouting Hose	The means by which grout is inserted to the foundation.
Inter-array cables	Electricity cables connecting the WTGs.
Licensable Marine Activity	Any activity listed in section 21(1) of the 2010 Act.
the Licensee	Aberdeen Offshore Wind Farm Limited, a company registered in Scotland (registered number SC278869).
Licensing Authority	Scottish Ministers, as defined by the Marine Licence. It is important to note that Marine Scotland is acting on behalf of Scottish Ministers.
Marine Licence	Licence issued by the Scottish Ministers under Part 4 of the Marine (Scotland) Act 2010 for construction works and deposits of substances or objects in the Scottish Marine Area in relation to the Offshore Wind Farm and Export Cable Corridor.
Marine Pollution Contingency Plan (MPCP)	The Plan to be submitted for approval under Condition 3.1.11 of the Marine Licence.
Navigational Safety Plan (NSP)	The Plan to be submitted for approval under Condition 26 of the section 36 Consent.
Offshore Consents	<ul style="list-style-type: none"> <li>Consent granted under section 36 of the Electricity Act 1989 for the construction and operation of the EOWDC;</li> <li>Declarations granted under section 36A of the Electricity Act 1989 to extinguish public rights of navigation so far as they pass through those places within the territorial sea where structures forming part of the Offshore Wind Farm are to be located; and</li> <li>Marine Licence under Part 4 of the Marine (Scotland) Act 2010 for construction works and deposits of substances or objects in the Scottish Marine Area in relation to the Offshore Wind Farm and Export Cable Corridor.</li> </ul>
Offshore Export Cable (OEC)	The offshore export cables (and all associated cable protections) connecting the WTGs to the onshore export cables.
Offshore Export Cable Corridor (OECC)	The consented area within which the offshore export cables will be laid up to MHWS.
Offshore wind farm	An offshore generating station which includes proposed WTGs, inter-array cables, meteorological masts and other

Term	Definition
	associated and ancillary elements and works (such as metocean buoys). This includes all permanent and temporary works required.
Planning Authorities	Aberdeenshire Council and Aberdeen City Council.
Offshore Environmental Management Plan (OEMP)	The Plan to be submitted for approval under Condition 17 of the section 36 Consent.
Section 36 Consent	Consent granted under section 36 of the Electricity Act 1989 for the construction and operation of the EOWDC.
Scottish Marine Area	The area of sea within the seaward limits of the territorial sea of the United Kingdom adjacent to Scotland and includes the bed and subsoil of the sea within that area.
Subcontractor	Any Contractor/Supplier (individual or firm) providing services to the project, hired by the Contractors (not AOWFL).
Supplementary Environmental Information Statement (SEIS)	The Statement submitted to the Scottish Ministers by the Company on 6 <sup>th</sup> August 2012 as part of the Application.
Foundation	Term used to describe the combined suction bucket foundations, jacket substructure and transition piece components that together support the wind turbines.
the Statement	The UK Marine Policy Statement 2011.
Target Burial Depth	The burial depth that is planned for the cables to be installed to (distance from the sea bed level to the top of the cable).
Vessel Management Plan (VMP)	The Plan to be submitted for approval under Condition 24 of the Section 36 Consent.
the Works	The European Offshore Wind Deployment Centre electricity generating station in Aberdeen Bay, approximately 2 kilometres east of Blackdog, Aberdeenshire, as described by the Marine Licence.

## Acronym Definitions

Term	Definition
AOWFL	Aberdeen Offshore Wind Farm Limited
CAA	The Civil Aviation Authority
CDM	Construction and Design Management
CLS	Cable Laying Strategy
CMS	Construction Method Statement
CNMP	Construction Noise Management Plan
COSHH	Control of Substances Hazardous to Health
CSV	Construction Support Vessel
DP	Dynamic Positioning
DS	Design Statement
ECow	Ecological Clerk of Works
Electricity Act	the Electricity Act 1989 (as amended)
EMF	Electromagnetic Field
EOWDC	European Offshore Wind Deployment Centre
ES	Environmental Statement
HDPE	High Density Polyethylene
HLV	Heavy Lift Vessel
HSSE	Health, Safety, Security and Environment
IALA	International Association of Marine Aids to Navigation and Lighthouses
IMO	International Maritime Organisation
ISO	International Organisation for Standardisation
KIS	Kingfisher Information Services
km	Kilometre
KP	Kilometre Point
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	The Maritime and Coastguard Agency
MHWS	Mean High Water Springs
MOD	Ministry of Defence
MPCP	Marine Pollution Contingency Plan

Term	Definition
MS-LOT	Marine Scotland - Licensing and Operations Team
MW	Megawatt
NLB	Northern Lighthouse Board
NMP	Navigational Marking Plan
NSP	Navigational Safety Plan
OEC	Offshore Export Cable
OECC	Offshore Export Cable Corridor
OTJB	Onshore Transition Joint Bay
PAM	Passive Acoustic Monitoring
PLGR	Pre Lay Grapnel Run
ROV	Remotely Operated Vehicle
SCADA	Supervisory Control and Data Acquisition
SEIS	Supplementary Environmental Information Statement
SNH	Scottish Natural Heritage
SOPEP	Ship Oil Pollution Emergency Plan
UXO	Unexploded Ordnance
VMP	Vessel Management Plan
WTG	Wind Turbine Generator

# 1 INTRODUCTION

## 1.1 Background

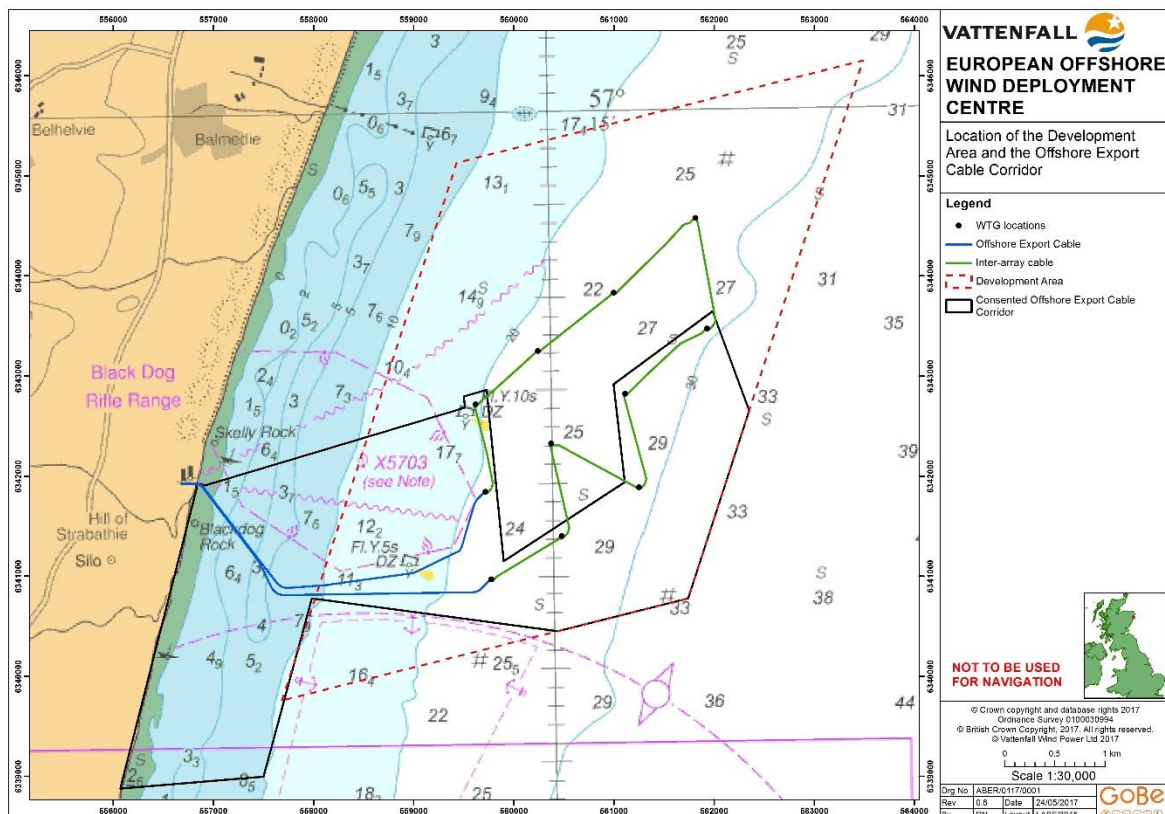
On 26 March 2013, Aberdeen Offshore Wind Farm Limited (AOWFL) received consent from the Scottish Ministers under Section 36 (S.36) of the Electricity Act 1989 for the construction and operation of the European Offshore Wind Deployment Centre (EOWDC - also known as the Aberdeen Offshore Wind Farm) and on 15 August 2014 a Marine Licence was attained under section 25 of the Marine (Scotland) Act 2010 (reference 04309/16/0). This Marine Licence was most recently varied on 30 September 2016 (reference 04309/16/1).

The Development is located approximately 2 to 4.5 km offshore to the north east of Aberdeen, Scotland, within Aberdeen Bay. The Offshore Export Cables (OECs) will be between 3.7 – 4.4 km long (maximum total length ~8 km) and will reach landfall at the adjacent coastline in Aberdeen Bay, at Blackdog (Figure 1).

A further overview of the Development is contained in Section 4 of this document.

Aberdeen Offshore Wind Farm Limited (AOWFL) is a company wholly owned by Vattenfall and was established to develop, finance, construct, operate, maintain, and decommission the EOWDC.

**Figure 1 Location of the Development Area and the Offshore Export Cable Corridor.**



## 1.2 Objectives of this Document

The S.36 Consent and Marine Licence contain a number 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 approval of a Construction Method Statement (CMS). The aim of this plan is to set out construction procedures and good working practices in the installation of the EOWDC.

The relevant conditions setting out the requirement for a CMS, that are to be discharged by this document, are presented in full in Table 1.

**Table 1 Consent conditions to be discharged by the CMS**

Consent Document	Condition Reference	Condition Text	Where Addressed
S.36 Consent	Condition 13	Prior to the Commencement of Development a Construction Method Statement ("CMS") must be submitted by the Company to the Scottish Ministers and approved, in writing by the Scottish Ministers, following consultation with Scottish Natural Heritage, Scottish Environment Protection Agency, the Marine and Coastguard Agency, the Planning Authorities, Northern Lighthouse Board, and any such other advisors as may be required at the discretion of the Scottish Ministers.	This document sets out the CMS for approval by the Scottish Ministers.
		Unless otherwise agreed in writing by the Scottish Ministers, construction of the Development must proceed in accordance with the approved CMS.	Consultation to be undertaken by Scottish Ministers.
		The CMS must include, but not be limited to, information on the following matters:	
		(a) Commencement dates;	Section 6.2
		(b) Working methods including the scope, frequency and hours of operations;	Section 5 and 6.3
		(c) Duration and Phasing Information of key elements of construction, for example turbine structures, foundations, turbine locations, inter-array cabling and land fall cabling;	Section 6.2
		(d) Method of installation including techniques and equipment and depth of cable laying and cable landing sites;	Section 5
		(e) The use of Dynamic Positioning vessels and safety/guard vessels;	Section 8.2
		(f) Pollution prevention measures including contingency plans; and	Section 9 and Marine Pollution Contingency Plan (EOWDC Document Reference: ABE-ENV-QB-0004) to be submitted separately.

Consent Document	Condition Reference	Condition Text	Where Addressed
		(g) Design Statement	Section 10 and Design Statement (EOWDC Document Reference: ABE-ENV-BD-0017) to be submitted separately.
		The CMS must be cross referenced with the Project Environmental Management Plan, the Vessel Management Plan and the Navigational Safety Plan.	Section 1.3
	Reason	To ensure the appropriate construction management of the Development, taking into account mitigation measures to protect the environment and other users of the marine area.	

### 1.3 Linkages with other Consent Plans

This CMS sets out the proposed offshore construction methods for the EOWDC. Ultimately, however, it will form part of a suite of approved documents that will provide the framework for the construction process – namely the other Consent Plans required under the S. 36 Consent and Marine Licence.

Indeed, Condition 13 of the S.36 Consent (see Table 1 above) requires this CMS to be, so far as is reasonably practicable, consistent with a number of other consent plans, namely (in the order listed in the consent condition):

- The Offshore Environmental Management Plan (OEMP) (EOWDC Document Reference: ABE-ENV-DB-0012) (required under Condition 17 of the S.36 Consent);
- The Vessel Management Plan (VMP) (EOWDC Document Reference: ABE-ENV-BD-0006) (required under Condition 24 of the S.36 Consent); and
- The Navigational Safety Plan (NSP) (EOWDC Document Reference: ABE-ENV-QB-0008) (required under Condition 26 of the S.36 Consent).

These plans named in the consent clearly have a link to the CMS in so far as they provide additional details on vessel activity and the safety of navigation (i.e. the VMP and the NSP), or provide details on the control of construction and operational activities to mitigate or manage potential environmental impacts (i.e. the OEMP).

The OEMP, VMP and NSP will be submitted for approval by the Scottish Ministers and consistency between these documents will be achieved by ensuring that all relevant documents are consistent with the terms of any previously submitted or approved documents.



## 1.4 Structure of this CMS

In response to the specific requirements of the S.36 Consent and the Marine Licence conditions, this CMS has been structured so as to be clear that each part of the specific requirements have been met and that the relevant information to allow the Scottish ministers to approve the CMS has been provided. The document structure is set out in Table 2.

**Table 2 CMS document structure**

Section		Summary of Content
1	Introduction	Background to consent requirements and overview of the CMS scope and structure, and identifies those other Consent Plans relevant to the CMS and provides a statement of consistency between this CMS and those plans.
2	AOWFL Statements of Compliance	Sets out the AOWFL statements of compliance in relation to the CMS and the broader construction process.
3	Updates and amendments to this CMS	Sets out the procedures for any required updating to or amending of the approved CMS and subsequent further approval by the Scottish Ministers.
4	Development Overview	Provides an overview of the Development.
5	Construction and Installation Methods	Sets out the construction methods in relation to each of the main components of the Development.
6	Commencement Dates and Duration and Phasing of Key Elements	Provides the commencement dates, duration, phasing and hours of operation.
7	Contractors and Subcontractors	Sets out the key roles and responsibilities within AOWFL, Contractors and Subcontractors.
8	Marine Coordination, Vessels and Construction Ports	Sets out details on marine coordination, vessels and construction ports.
9	Pollution Prevention Measures (Including Contingency Plans and General Environmental Management Measures)	Refers to the Pollution Prevention Measures in place including Contingency Plans.
10	Design Statement	Refers to the technical detail on aspects of the Development including turbine layout, height, lighting requirements and a visual assessment (EOWDC Document Reference: ABE-ENV-BD-0017)
11	Compliance with the Application and Associated SEIS	Sets out confirmation that the details set out in this CMS are in accordance with those assessed in the ES and SEIS; and sets out how the mitigation measures related to construction identified in the ES and SEIS are to be delivered (by reference to this CMS or other relevant consent plans).
12	References	Lists the documents cited within the Plan.
Appendix A – Compliance with Rochdale Envelope Parameters		Demonstrates compliance with the original Application and mitigation set out in the ES and SEIS.
Appendix B – Compliance with Mitigation Measures		Details the ES and SEIS commitments relevant to this CMS.

## **2 AOWFL STATEMENTS OF COMPLIANCE**

### **2.1 Introduction**

---

The following statements are intended to reaffirm the AOWFL commitment to ensuring that the Development is constructed and operated in such a manner as to meet the relevant requirements set out by the Offshore Consents, as well as other broader legislative requirements.

### **2.2 Statements of Compliance**

---

AOWFL, in undertaking the construction of the EOWDC, will ensure compliance with this CMS as approved by the Scottish Ministers (and as updated or amended from time to time following the procedure set out in Section 3 of this CMS).

AOWFL, in undertaking the construction of the EOWDC, will ensure compliance with other relevant Consent Plans, as approved by the Scottish Ministers, and as identified in Section 1.3 above.

AOWFL, in undertaking the construction of the EOWDC, will ensure compliance with the limits defined by the original application, the project description defined in the Environmental Statement (ES) and Supplementary Environmental Information Statement (SEIS) and referred to in Annex 1 of the S.36 Consent in so far as they apply to this CMS (unless otherwise approved in advance by the Scottish Ministers / the Licensing Authority).

AOWFL, in undertaking the construction of the EOWDC, will comply with AOWFL Health, Safety, Security and Environment (HSSE) systems and standards, the relevant HSSE legislation and such other relevant legislation and guidance so as to protect the safety of construction personnel and other third parties.

Further detail on environmental management is set out, for approval, in the OEMP; the installation of the Development described by this CMS will be undertaken in line with the procedures and practices set out in the OEMP.

The Development is a notifiable project for the purposes of the Construction (Design and Management) Regulations 2015 (CDM regulations). AOWFL will ensure compliance with the CDM regulations in the design of the Development and through the completion of the construction process.

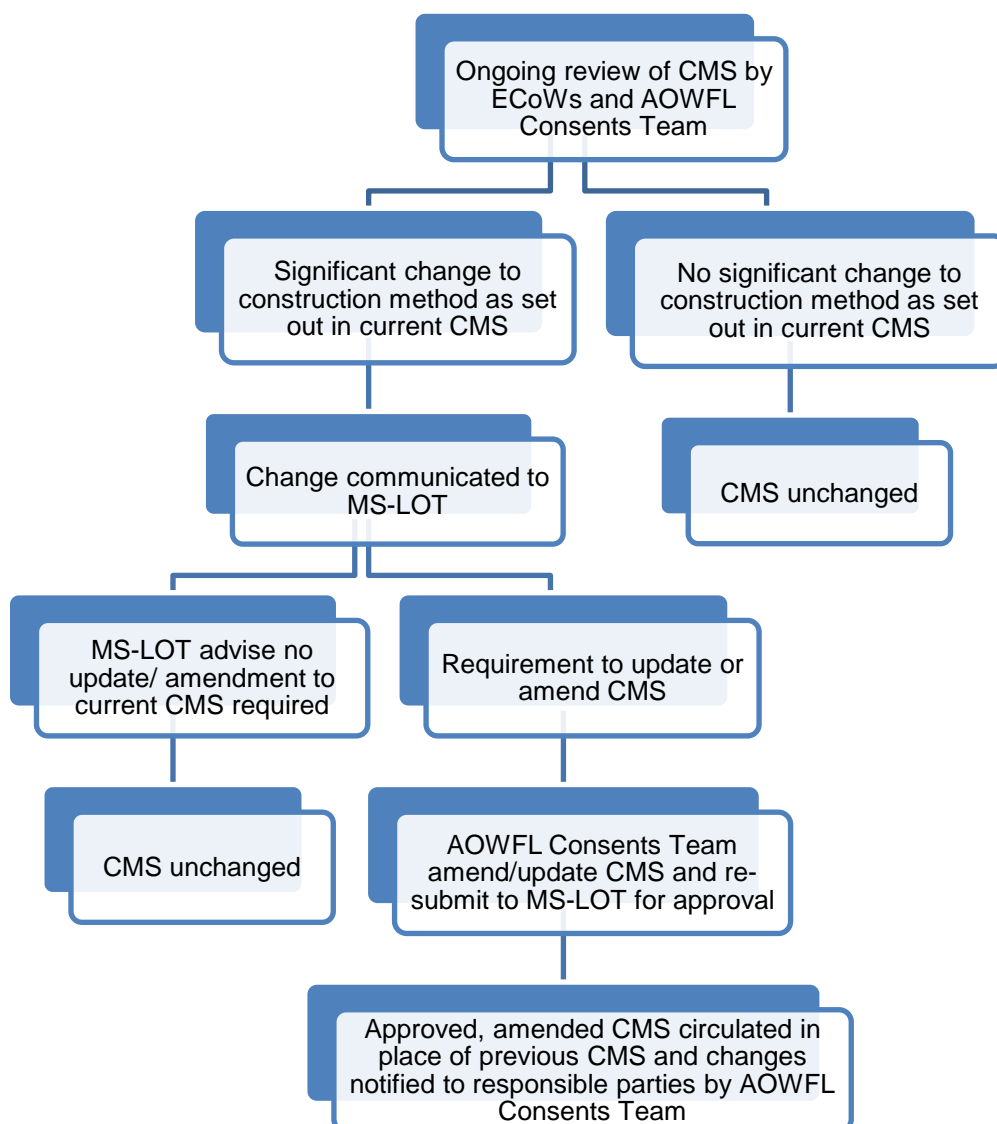
AOWFL will require compliance with the Control of Substances Hazardous to Health Regulations 2002, (COSHH) in ensuring that the risk to health from workplace exposure to hazardous substances is appropriately assessed and that exposure is prevented or, where this is not reasonably practicable, adequate controls are implemented and exposure monitored and managed to within acceptable levels in line with relevant regulations.

AOWFL will, in undertaking the construction of the EOWDC, ensure compliance with all other relevant legislation and require that all necessary licences and permissions are obtained by the Contractors and Subcontractors through condition of contract and by an appropriate auditing process.

### 3 UPDATES AND AMENDMENTS TO THIS CMS

Where it is necessary to update this CMS in the light of any significant new information related to the construction methods, AOWFL proposes to use the change management process set out in Figure 2; identifying such information, communicating such change to the Scottish Ministers, redrafting the CMS if required, seeking further approval for the necessary amendments or updates and disseminating the approved changes/amendments to responsible parties.

**Figure 2 CMS Change Management Procedure**



## **4 DEVELOPMENT OVERVIEW**

### **4.1 Introduction**

---

This section provides a brief overview of the EOWDC relevant to this CMS and Figure 1 shows the location of the EOWDC in Aberdeen Bay.

### **4.2 Development Overview**

---

The Development will consist of the following main components:

- 11 Wind Turbine Generators (WTGs);
- Three legged jacket substructures each installed on suction bucket foundations;
- A network of circa 9.7 km of Inter-array cables; and
- Two buried or mechanically protected, subsea OECs, totalling up to ~8 km in length, to transmit the electricity from the Wind Turbine Generators (WTGs) to the cable landfall location at Blackdog, within Aberdeen Bay, and connecting to the onshore buried cables for transmission to the onshore substation and connection to the National Grid network.

Further details of the Development layout and design will be set out, for approval, in the Design Statement (ABE-ENV-BD-0017) as referred to in Section 10 of this CMS.

.

## 5 CONSTRUCTION AND INSTALLATION METHODS

### 5.1 Introduction

---

The following sections set out the method of installation for the main construction components covered by this CMS, namely;

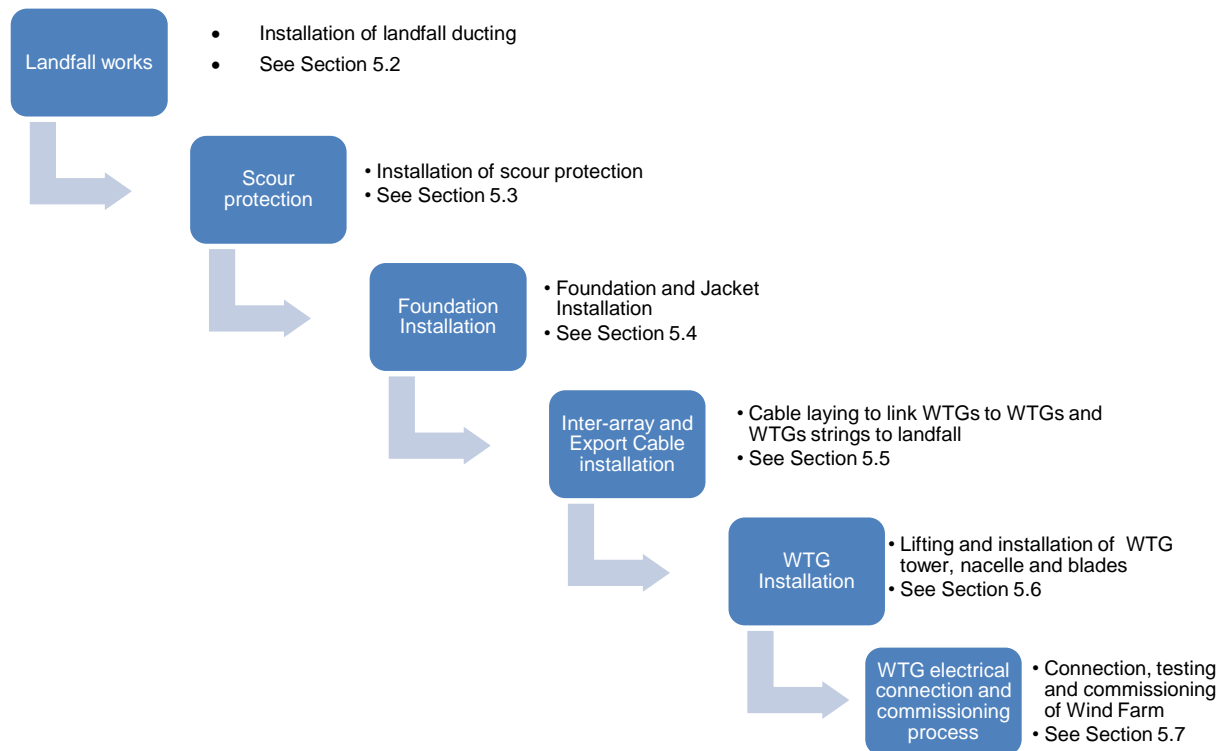
- Cable landfall;
- Scour protection for the foundation structures;
- Suction bucket jacket foundations (single operation);
- Inter-array cables;
- Offshore Export Cables;
- WTGs; and
- Electrical connection and commissioning.

The information set out in this section is in relation to the S.36 Condition 13d) which requires that the CMS describes the:

*‘Method of installation including techniques and equipment and depth of cable laying and landing sites.’*

A simple overview of the main stages of the construction process is provided in Figure 3 including cross references to the sections where more detailed information for each of the elements of the sequence is provided.

**Figure 3 Overview of Development Construction Process**



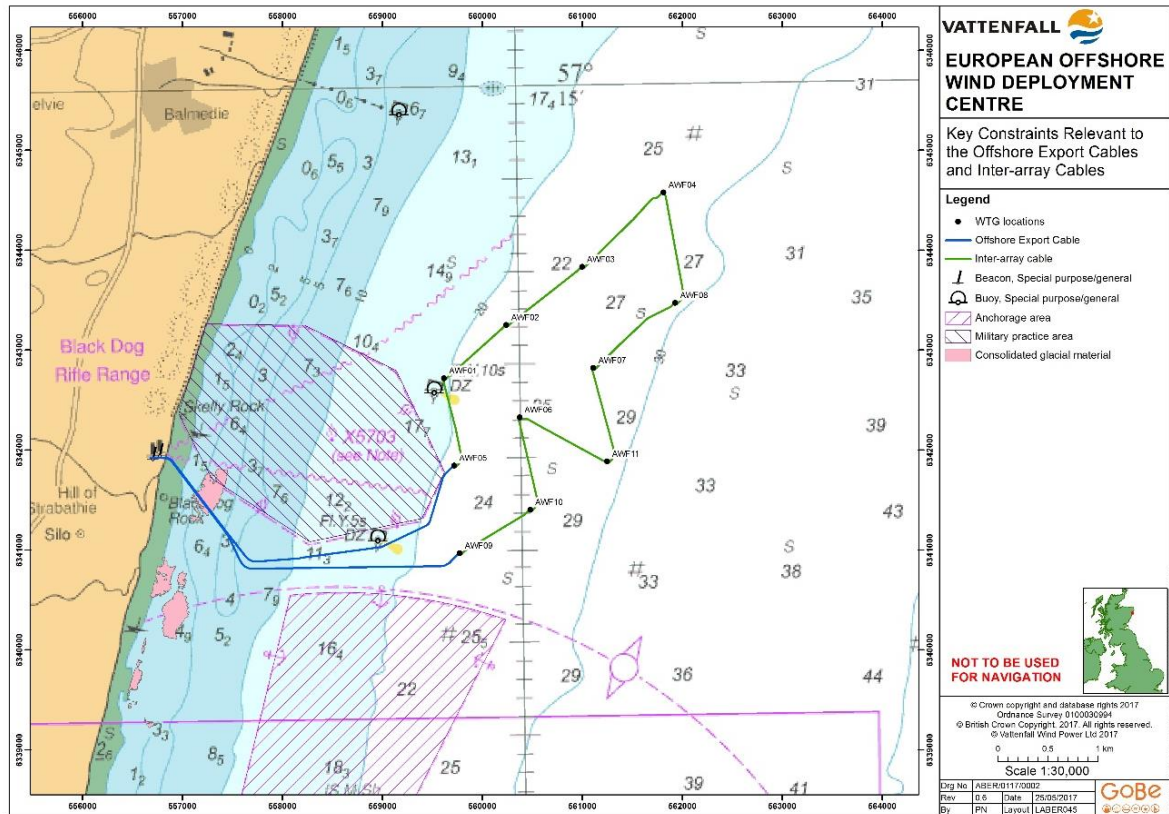
## 5.2 Landfall works

The landfall location lies within the consented OECC (Figure 4).

At the landfall location by the Blackdog Burn, two High Density Polyethylene (HDPE) ducts for the OEC will be installed by trenching methods between the onshore transition joint bay (OTJB) and the offshore Kilometre Point (KP) 0.25 which will cross the Blackdog Burn, a small stream running on the beach parallel to the water line. The ducts will be approximately 150 m long, with the option of duct extensions of approximately 850 m in length currently being considered.

The indicative landfall location coordinates are presented in Section 6.2.1 of the Cable Laying Strategy (EOWDC Document Reference Number ABE-ENV-DB-0003).

**Figure 4 Offshore Export Cables layout and Inter-array cable layout (subject to micrositing)**





### 5.3 Scour Protection

Scour protection consisting of rocks and stones will be loaded onto a scour protection installation vessel and transported directly to the Development Area.

The scour protection will be installed using a fall pipe to a radius of approximately 7.25 m around the suction bucket with a total thickness of approximately 1.5 m. A Remotely Operated Vehicle (ROV) will be used for visual checks on the scour protection.

Two designs are currently under consideration, the first configuration has a dual layer consisting of a filter and an armour layer (Figure 5) and the second design consists of a single rock/stone layer.

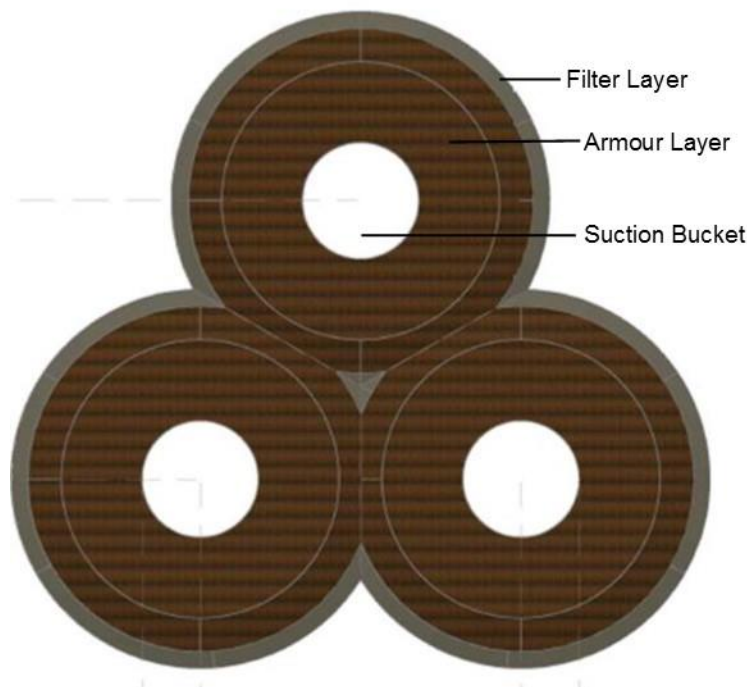
The proposed scour protection materials currently under consideration are:

- High Density rock/stone ( $> 3000 \text{ kg/m}^3$ );
- Rock/stone gradings of approximately 2-8" or 3-9" for the single layer; and
- 10-200 kg rocks/stones for the armour layer of the dual layer configuration.

Final dimensions will be decided based on availability of material.

The majority of scour protection will be installed prior to foundation installation although some finalisation of scour protection may occur after foundation installation.

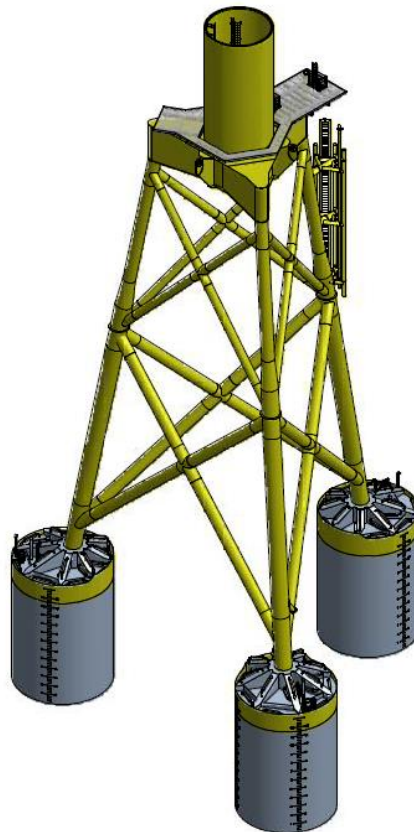
**Figure 5 Top view of scour protection design option with filter and armour layer**



## 5.4 Foundation Installation

The foundations for each of the WTGs comprise of a jacket lattice structure with three suction buckets, as shown in Figure 6.

**Figure 6 Suction Bucket Foundations and Jacket**



### 5.4.1 Components to be installed

The main components of the foundation that will be installed are summarised in Table 3.

**Table 3 Summary of foundation components to be deposited or installed**

Component	Number	Key dimensions
Suction bucket foundations	11 x 3	Suction bucket diameter: 9.5 m (7 WTGs) and 10.5 m (4 WTGs) Height 7.5-13.0 m
Jacket (including flanged WTG/jacket transition piece connection)	11	Height: variable circa 60 to 78 m (dependent on water depth).

The foundation, comprised of the suction buckets, jacket and transition piece will be installed as one unit. The transition piece forms the connection between the foundation and the WTG tower. The foundation will be fully assembled onshore in the fabrication yard before being loaded-out for installation.

Further details on the key parameters for each of these components is provided in Appendix A by comparison to the maximum consented values.

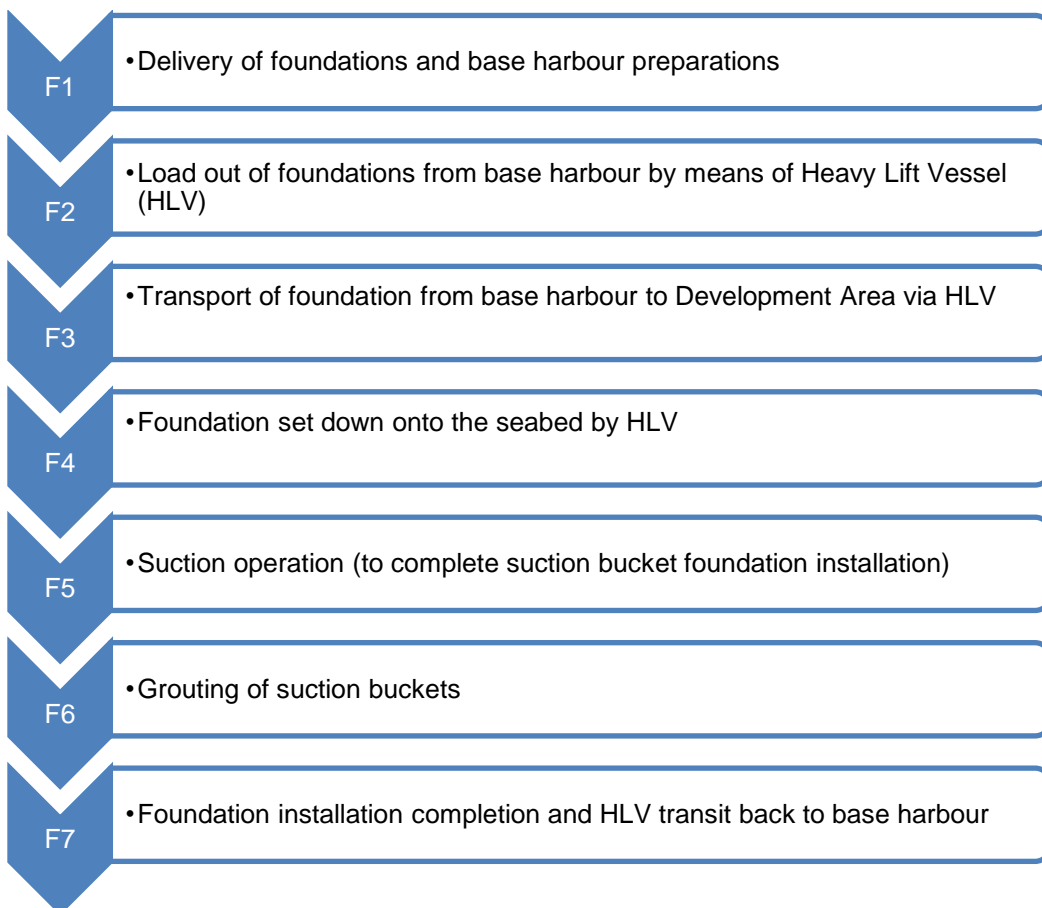
#### 5.4.2 Delivery to the Construction Site

The foundations will be assembled in the Smulders Projects UK Assembly Yard located at Wallsend, on the River Tyne, with subsequent delivery to Peterhead, acting as a local feeder port. The foundations will then be delivered to the site from Peterhead.

#### 5.4.3 Method and Process of Installation

An indicative foundation installation sequence is presented in Figure 7 below. Greater detail on each of the stages in the installation process (F1 – F7) is then provided in the subsequent sections.

**Figure 7 Foundation Installation Sequence**



#### 5.4.4 Stage F1 - Delivery of Foundations and Base Harbour Preparations

Following the delivery of the foundations by transport barge to Peterhead Port, they will be prepared for installation, including the following:

- Installation of suction pump units onto the buckets by means of an onshore crane;
- Umbilical routing and connection of suction pump unit;
- Grouting hose routing and connection to suction buckets; and
- Installation of survey equipment.

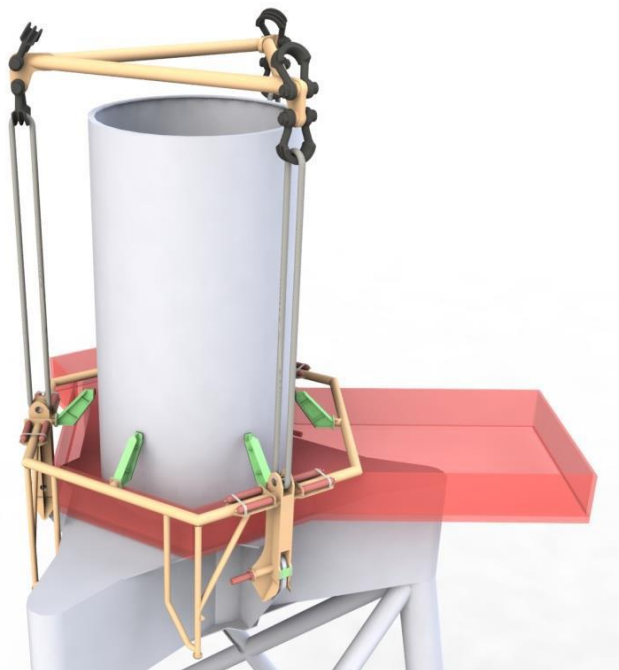
All systems will be checked and tested and additional equipment tests will be undertaken for the temporary installation equipment such as the suction pumps, survey grouting spread and lifting equipment prior to the foundation transit to the site.

#### 5.4.5 Stage F2 - Load Out of Foundation

The load out of the foundation will be undertaken in Peterhead Port.

After mooring the Heavy Lift Vessel (HLV) will position itself above the foundation before lowering and connecting the lifting arrangement to the pad eyes on top of the foundation (Figure 8). After connection, the HLV will increase the tension on the hooks in steps until approximately 80 % of the load is transferred from the transport barge to the HLV and the HLV will slack its mooring wires to float above the centre of gravity of the foundation. The HLV will then tension up its mooring arrangement and lift the foundation from the transportation barge-until it is suspended in air. The HLV moorings will then be released, the vessel's anchors picked up and vessel will transit to the installation site.

***Figure 8 Indicative Lifting Arrangement (pending confirmation of final design)***



#### 5.4.6 Stage F3 - Transport of foundation from base harbour to Development Area

The HLV anchor spread will be set out with the assistance of anchor handling tugs, prior to the arrival of the HLV at the target installation location. The HLV will transit to the Development Area with one jacket foundation safely hooked on.

#### 5.4.7 Stage F4 - Foundation Set Down onto the seabed

The HLV will position the foundation in the pre-defined target box at the target WTG location and lower the foundation until it is approximately 3 m above the seabed. Surveys will confirm the foundation is within the target box. The HLV will then lower the foundation on to the seabed. An ROV will be used to monitor this process.

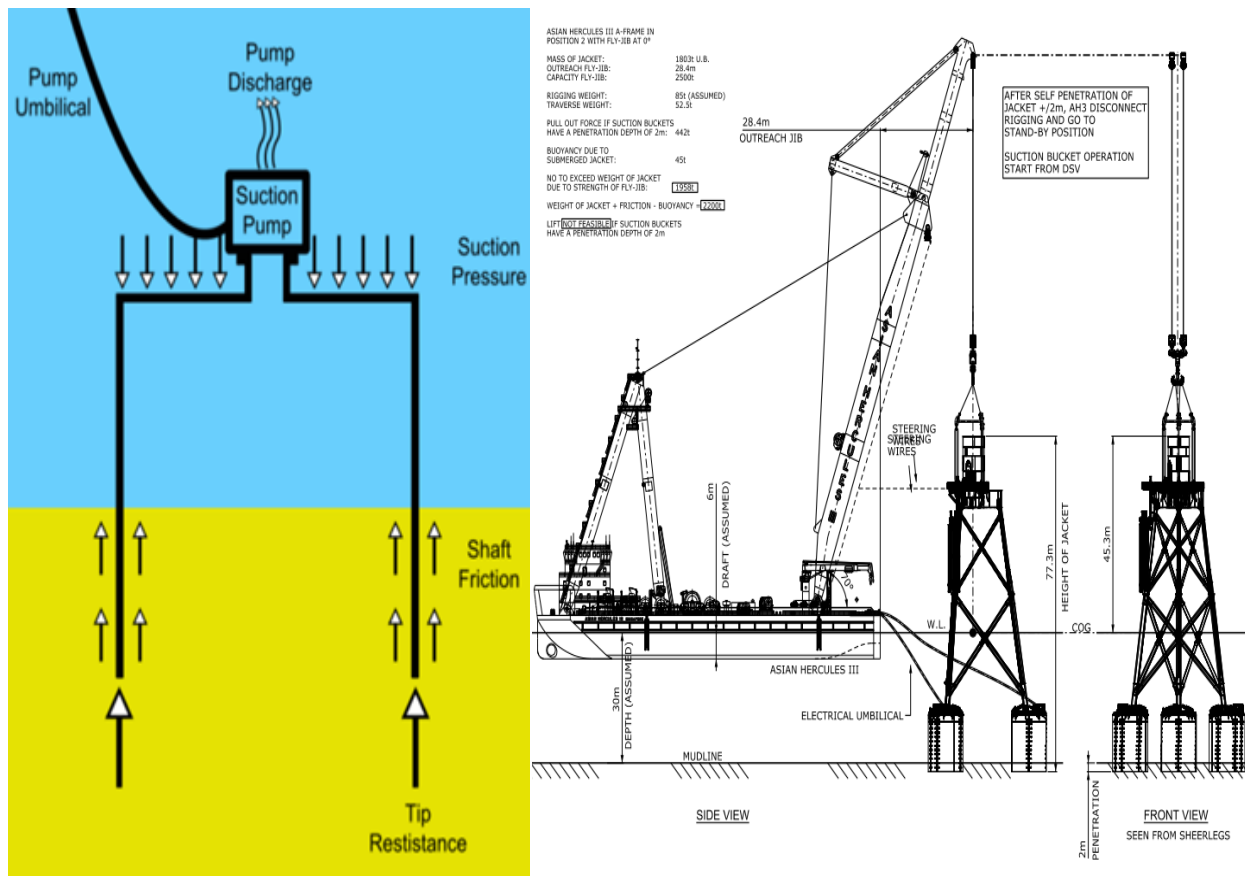
After confirmation from the survey data that the foundation is correctly sited the lifting rigging will be disconnected and preparations will commence for the suction operation.

#### 5.4.8 Stage F5 - Suction Operation

The suction bucket foundations work by pumps removing the water from inside the suction bucket structures thereby creating a pressure differential between the inside and the outside of the suction buckets which acts to “push” the foundation through the soil of the seabed. The valves of the suction pumps will be remotely closed and the water pumps activated to initiate this pressure differential. Figure 9 shows a schematic example of the suction operation and also an indicative schematic for the HLV arrangement after completion of the suction operation.

An ROV will be used to monitor the operation to check for any refusal conditions and visual verification of penetration depths of each of the three suction bucket foundations.

**Figure 9 Indicative Suction Bucket Installation Operation**



#### 5.4.9 Stage F6 - Grouting Operation

Once the suction operation is complete and foundation penetration is confirmed, the remaining space above the soil plug and the top plate of the suction buckets will be filled with a grout mixture.

The grout to be used will be of a low strength. Approximately 110 - 130 m<sup>3</sup> of grout will be required for each suction bucket foundation depending on bucket diameter.

Grout will be mixed using seawater on board vessel construction support vessel (CSV) and stored in grout silos ready for use. The grout will be pumped using a high pressure system through high pressure grout delivery hoses connected to connectors on the suction bucket foundations. It is likely that the grout will be a sodium silicate mixture with an installation time of approximately 8 hours per foundation and a curing time of 36 to 48 hours.

#### 5.4.10 Stage F7 - Foundation installation completion and HLV transit back to base harbour

Following the completion of the foundation installation, the following equipment will be removed:

- Disconnect rigging from foundation (remotely from the HLV);
- Remove suction pump units (by CSV);
- Remove survey equipment (likely by CSV); and
- Remove grouting hoses (by CSV).



After the rigging equipment is retrieved, the HLV will unmoor from its anchor pattern and return to Peterhead Port for the next foundation installation cycle.

### 5.5 Inter-array and Export Cable Installation

#### 5.5.1 Components to be installed

The main components that will be deposited or installed are summarised in Table 4.

**Table 4 Summary of cable components to be deposited or installed**

Component	Description	Image	Key dimensions
Inter-array cabling	<ul style="list-style-type: none"> <li>• Three core 66 kV steel sheathed, armoured submarine power cable;</li> <li>• Three copper-core conductor of 400 mm<sup>2</sup> cross section.</li> </ul>		Up to approximately 9.7 km in total length
Export Cables	<ul style="list-style-type: none"> <li>• Three core 66 kV steel sheathed, armoured submarine power cable;</li> <li>• Three copper-core conductor of 400, mm<sup>2</sup> cross section.</li> </ul>		Up to approximately 8 km in total length

Further details on the key parameters for each of these components is provided in Appendix A by comparison to the maximum consented values.

#### 5.5.2 Delivery to the Construction Site

Inter-array and export cables will be delivered to site direct from the point of manufacture in Hartlepool by sea transport.

### 5.5.3 Method and Process of Installation

The following sections summarise the main stages of the cable installation process including seabed preparation, inter-array and export cable installation and by reference to the separate Cable Laying Strategy (incorporating the Cable Attenuation Report and the Cable Protection Plan) submitted for approval pursuant to the discharge of S.36 Consent Condition 25 and the Marine Licence Conditions 3.2.1.2 & 3.2.1.7 (EOWDC Document Reference Number ABE-ENV-DB-0003)).

### 5.5.4 Seabed Preparation

Prior to cable installation, a survey will be completed by the Contractor or Subcontractor to confirm there are no additional unknown hazards present (such as boulders and UXO). An ROV may be used during the survey but this is yet to be confirmed. Should any hazards be identified, further minor modifications to the location or protection of cables may be proposed. These will not constitute significant changes to the cable route and these minor modifications are referenced as cable micro-siting.

A pre-lay survey will be undertaken a couple of weeks prior to the start of the installation of the cables to determine the reference level for the cable burial and any further micro-siting requirements.

Seabed debris, such as fishing gear and abandoned wires or chains, can be detrimental to cable lay and cable burial operations and there is a risk that the cable installation tools, intended to be used to bury the cables, could become entangled or stuck. Therefore, approximately one month prior to the start of cable laying operations, the cable routes will be cleared of any surface debris crossing the cable routes by the use of a Pre-Lay Grapple Run (PLGR). Greater detail on the PLGR is provided in Section 9.2.3 the Cable Laying Strategy (EOWDC Document Reference Number ABE-ENV-DB-0003).

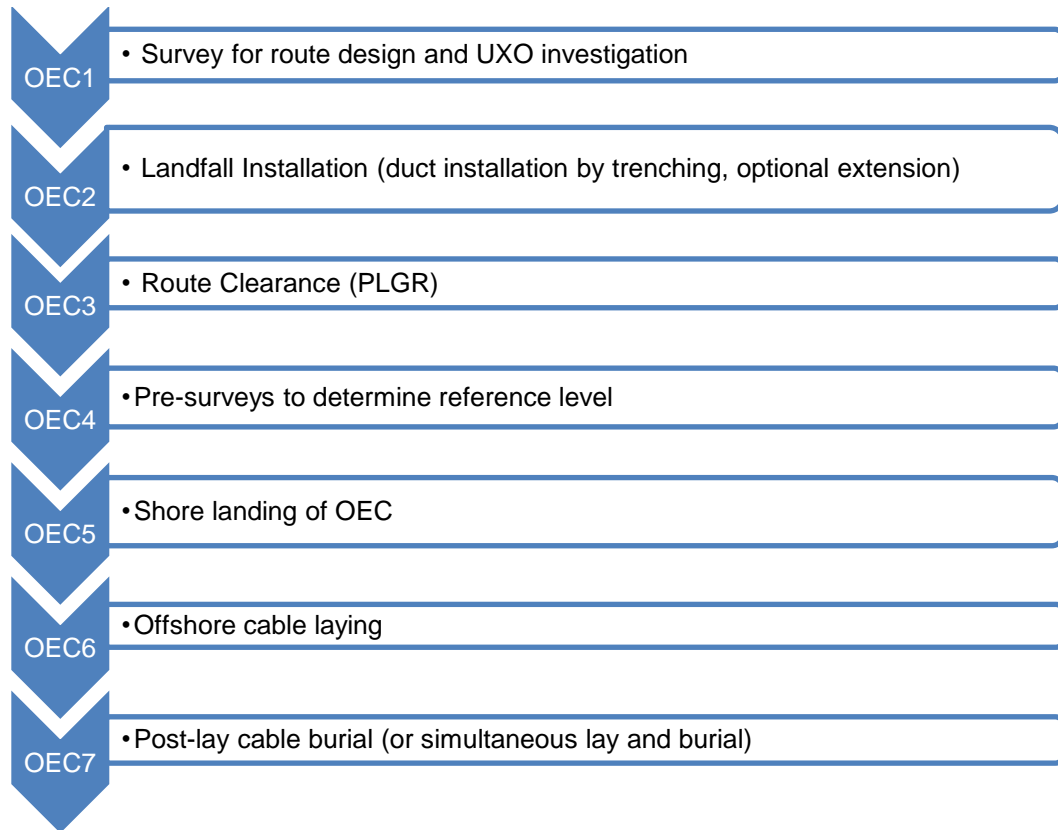
### 5.5.5 Export Cable Installation

An indicative installation sequence for the Offshore Export Cables (OECs) is presented in Figure 10.

Greater detail on each of the stages in the installation process (OEC 1 – 7) (Figure 10) including installation techniques, equipment, depth of cable laying and cable landing site is provided in Section 9.2 of the Cable Laying Strategy (EOWDC Document Reference Number ABE-ENV-DB-0003).



**Figure 10 Offshore Export Cables Installation Sequence**

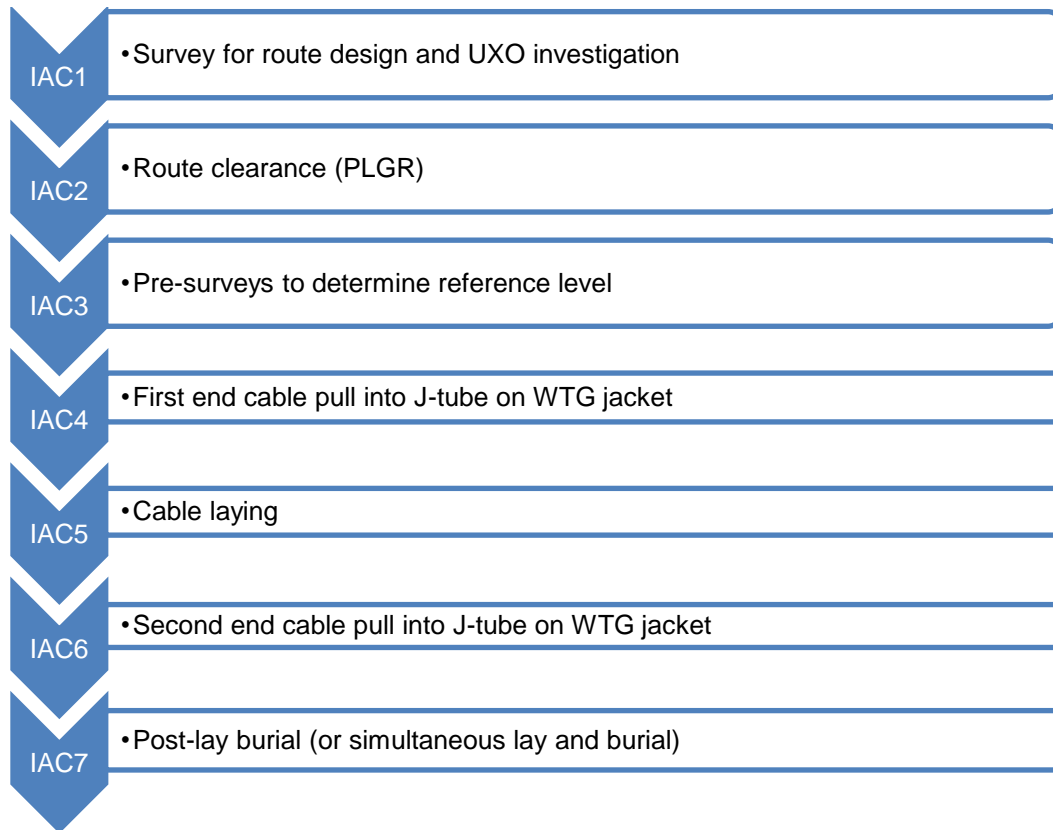


### 5.5.6 Inter-array Cable Installation

An indicative installation sequence for the Inter-array cables (IACs) is presented in Figure 11. Stages 1 – 3 of the sequence below will be undertaken in a single campaign in relation to both OECs and Inter-array cables.

Greater detail on each of the stages in the installation process (IAC 1 – 7) including installation techniques, equipment, depth of cable laying and cable landfall location is provided in Section 9.3 of the Cable Laying Strategy (EOWDC Document Reference Number ABE-ENV-DB-0003).

**Figure 11 Inter-array Cable Installation Sequence**



### 5.5.7 Cable Burial depths

In line with the current 'best practice' on Electromagnetic Fields (EMF), cables will be buried to a sufficient depth (with indicative burial depths of up to 1.5 m for OECs and 1.0 m for Inter-array cables, dependent on geological conditions). Further detail on EMF attenuation and cable burial depths is provided in Sections 8, 9 and 10 of the Cable Laying Strategy (EOWDC Document Reference Number ABE-ENV-DB-0003).

## 5.6 Wind Turbine Generator Installation

### 5.6.1 Components to be installed

The main components that will be deposited or installed are summarised in Table 5.

**Table 5 Summary of WTG components to be deposited or installed**

Component	Key dimensions
WTG tower sections	Hub Height:109 m (LAT) Base Tower diameter: 6.5 m Top Tower diameter: 4.5 m
WTG blades	Blade Length: 80 m (164 m Rotor Diameter)
WTG nacelle	20.5 m (length), 9 m (height) and 8.1 m (width)

Further details on the key parameters for each of these components is provided in Appendix B by comparison to the maximum consented values.

### 5.6.2 Delivery to the Construction Site

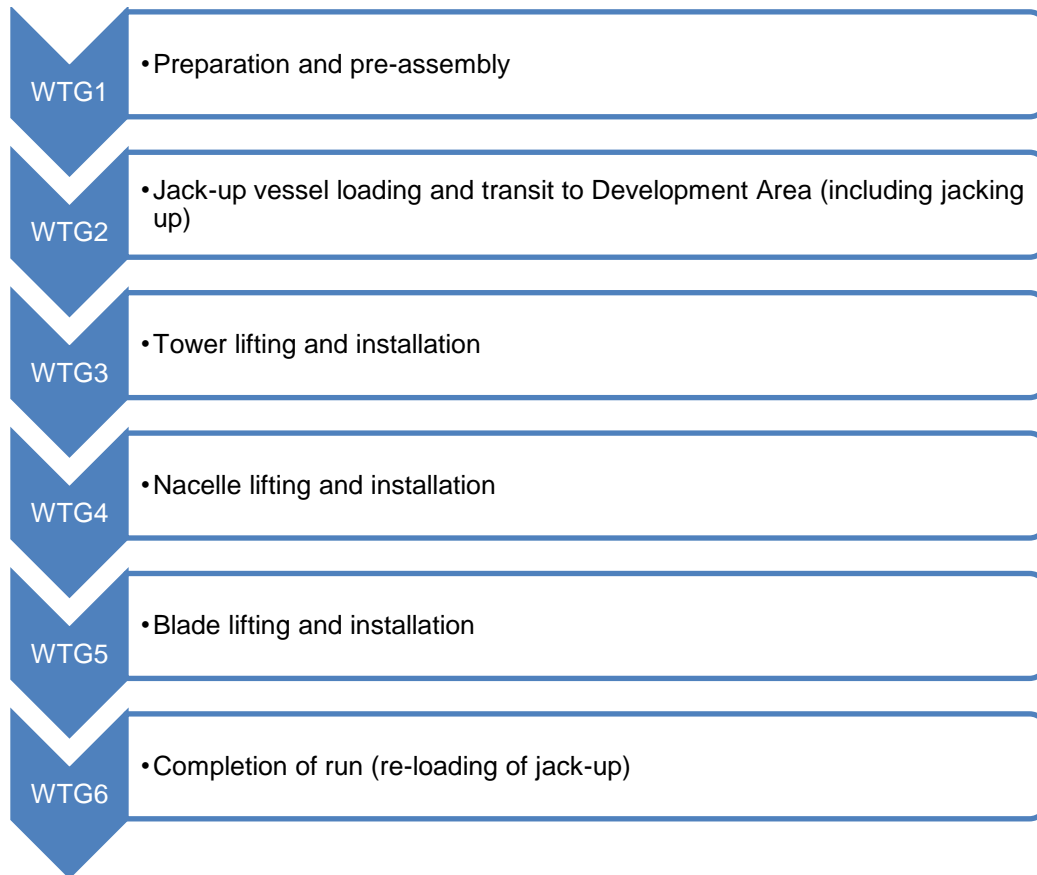
The WTGs will be transported by sea from the preassembly facilities in Esbjerg, Denmark directly to the Development Area.

### 5.6.3 Method and Process of Installation

An indicative WTG installation sequence for the WTGs is presented in Figure 12.

Greater detail on each of the stages in the installation process (WTG1 – WTG6) is then provided in the subsequent sections.

**Figure 12 WTG Installation Sequence**



#### **5.6.3.1 WTG Installation Stage WTG1 – Preparation and pre-assembly**

Prior to the WTG installation process commencing the transition pieces of the jacket foundation structures will be surveyed and checked and cleaned ready to accept the tower sections.

At the pre-assembly harbour, the WTG components will be readied for loading and installation. This includes:

- Pre-assembly of tower sections into complete towers;
- Preparation of the nacelles and installation of single blade lift turning gear;
- Preparation of blades;
- Preparation of all components for transport: provision of suitable weather protection, temporary fixing of assemblies, covering of hoses, cable ends and fibre optic-cables; and
- Preparation of all bolts, washers, nuts, specialist installation tools, bolt tensioning equipment etc. necessary to complete the WTG installation.

#### **5.6.3.2 WTG Installation Stage WTG2 – Jack-up loading and transit**

The WTG installation jack-up vessel will be positioned at the quayside of the pre-assembly harbour and readied for loading. The WTG components will then be loaded onto the jack-up vessel and sea-fastened ready for sea transport; a maximum of four complete WTGs are

normally loaded at a time (i.e. tower sections, nacelles and blades for three or four complete WTGs).

Once the WTG components are loaded, the jack-up vessel prepares for sea transportation and leaves the pre-assembly harbour, to be positioned at the first WTG location, adjacent to the pre-installed jacket foundation.

#### **5.6.3.3 WTG Installation Stage WTG3 – Tower lifting and installation**

Once the jack-up vessel is positioned adjacent to the jacket foundation, the jack-up lowers its legs (each equipped with spud cans, which are inverted cones mounted at the base of the jack-up that provide stability) to the seabed. The vessel then jacks up until the hull of the vessel is just above the water level.

A preload operation then takes place which varies for each site but commonly consists of lifting two diagonal opposite legs so that the weight of the vessel is shared only over two legs. This applies a load that is equal to or greater than the predicted loads the leg will see during construction activities. The preload operation is repeated for the other four legs. Following pre-load, the hull is jacked up further to the height above sea level as required for that particular vessel and the site conditions.

The vessel then prepares to lift the WTG tower (the tower having been pre-assembled at the pre-assembly harbour). The lifting and installation process then proceeds as follows:

- A Gangway is deployed to access the foundation;
- The temporary transition piece cover is removed;
- The rigging is prepared for the tower lift;
- The lifting gear is attached to the tower;
- The sea fastening bolts are released;
- The WTG tower is lifted and guided into position on the foundation transition piece;
- The correct tower position is confirmed and the connecting bolts are secured using torque and impact wrenches; and
- The lifting gear is disconnected from the tower and recovered to the installation vessel.

#### **WTG Installation Stage WTG4 – Nacelle lifting and installation**

Having completed the tower installation, the jack up vessel then prepares to lift the WTG nacelle. The nacelle is the main body of the WTG and houses the main generating plant and control systems. The nacelle is prepared for lifting.

The nacelle will then be lifted on to the top of the tower section as follows:

- The rigging is prepared for the nacelle lift;
- The lifting gear is attached to the nacelle;
- Tag lines are attached to the nacelle;
- The bolts are removed at the transport frame;

- The nacelle is lifted from the deck of the vessel and guided into position on the top of the tower;
- The correct nacelle position is confirmed and the connecting bolts are secured using torque and impact wrenches; and
- The lifting gear is disconnected from the nacelle and recovered to the installation vessel.

### ***WTG Installation Stage WTG5 – Blade lifting and installation***

The jack-up vessel will then prepare to lift the WTG blades.

The blades will be lifted one at a time into position on the nacelle as follows:

- The blade lifting tool is prepared;
- Tag lines are attached to the tool;
- Confirmation is sought that the personnel in the nacelle are ready for blade lifting and attachment;
- The lifting tool is attached to the blade and the frame/sea fastenings are released;
- The blade is lifted into position and secured on the nacelle rotor hub and secured with bolts;
- The lifting tool is released from the blade; and
- The lift rigging & slings are recovered back to the installation vessel.

The hub will then be rotated using the pre-installed blade turning gear and the second and third blades will then be lifted in turn and attached to the nacelle following the preceding sequence. When complete, the pre-installed blade turning gear will be removed.

### ***WTG Installation Stage WTG6 – Completion of run***

After completion of the WTG installation, the gangway will be retracted and stowed away and the jack up hull will be jacked down to sea level and the legs jacked up, releasing the spudcans from the seabed (a water jetting system will be used to release the spudcans from the seabed). The gangway and the jack up vessel will then move to the next jacket foundation to repeat the preceding WTG installation sequence (stages WTG 1-5).

Once all of the WTG's on board have been installed, the jack-up will be prepared for the return to port (stowing equipment etc.) and return to the pre-assembly harbour to load the next set of turbines.

Once the blades have been installed, the final turbine installation works will be completed including:

- Connecting of all electrical equipment in transition piece; and
- Mechanical completion of all mechanical systems in the WTG structure.

## 5.7 Wind Farm Electrical Connection and Commissioning

---

Once the Offshore Export Cables have been energised from the National Grid connection at Blackdog substation the process of offshore commissioning commences. Commissioning of the WTGs, will be carried out on an individual basis.

The required works that will be completed during commissioning of the Development in preparation for generation include the following:

- Provide power for the commissioning work;
- Testing of switchgear in the jacket foundation;
- Installation and commissioning of the internal personnel hoist / internal ladders in the WTG tower;
- Test and commissioning of internal personnel hoist;
- Final alignments of turbine drive train and associated ancillary equipment;
- Installation and testing of all fibre optic cables;
- Installation and commissioning of WTG SCADA system;
- Installation and commissioning of SCADA servers and related equipment for SCADA onshore substations; and
- Handover of commissioned and operating turbines.

The SCADA system is vital to the operation of the Development. The SCADA system connects the individual turbines to a central control system. This computer and the associated communication systems will allow remote supervision of the WTGs and the Development as a whole. It will keep a record of all the activity on and allows determination of any corrective action needed. It also records output, availability and error signals. Communication will be via optical fibres which are embedded in the subsea cables.

## 6 COMMENCEMENT DATES AND DURATION AND PHASING OF KEY COMPONENTS

### 6.1 Introduction

---

This section of the CMS provides an overview of the currently anticipated construction programme and outlines information pertaining to duration and phasing and working hours.

This section also cross-references to a number of the other consent plans where further information on these matters is provided (see also Section 1.3 of this CMS for linkages with other consent plans).

### 6.2 Commencement Dates and Duration and Phasing of Key Components

---

This section satisfies the requirements of S.36 Condition 13f) and 13c) pertaining to:

*‘Commencement Dates’*

*‘Duration and Phasing Information of key elements of construction, for example turbine structures, foundations, turbine locations, inter-array cabling and land fall cabling’*

AOWFL will, no less than one month before the intended Commencement of the Works, notify the Licencing Authority, in writing, of the date of Commencement of the Works and confirm the date no less than 24 hours before Commencement of the Works, in accordance with Marine Licence Condition 3.2.1.1.

Additionally, in accordance with S.36 Condition 1, written confirmation of the date of final Commissioning will be provided to the Scottish Ministers, Planning Authorities and SNH no later than one calendar month after the Final Commissioning of the Development. Finally, AOWFL will no later than one month following the Completion of the Works, notify the licensing Authority, in writing, of the completion date in order to satisfy Marine Licence Condition 3.2.3.1. The currently anticipated programme for EOWDC is outlined in Table 6 below (noting that this may be subject to change due to unforeseen circumstances, final project engineering works and weather delays).

The following terms, used in Table 6, are defined in the context of the Offshore Consents as follows;

- **Commencement of the Development:** The date on which the first vessel arrives on the Site of European Offshore Wind Deployment Centre to begin construction in accordance with the S.36 Consent.
- **Commencement of the Works:** The date on which the first vessel arrives on the Site to carry on any Marine Licensable Marine Activity in connection with the construction of the Works, as defined by the Marine Licence.



**Table 6 Anticipated construction programme**

Milestone or activity	Anticipated Installation Period
Commencement of the Development	July 2017
Landfall works	July 2017 - August 2017
Scour protection installation	August 2017 - November 2017
Installation of jacket and suction bucket foundations	September 2017 - December 2017
Installation of Offshore Export Cables	October 2017 - January 2018
Installation of Inter-array cables	December 2017 - February 2018
Installation of WTGs	March 2018 - June 2018
Offshore construction ends/ Completion of the Works	May 2018 - September 2018

### 6.3 Hours of Operations

The anticipated working hours for construction phases are detailed in the Construction Noise Management Plan (ABE\_ENV\_DC\_0005) and outlined below:

- All offshore activities: working hours will be 24 hours, 7 days a week;
- Working hours for the export cable installation trenching operations (located landward of the beach) are expected to be during the daytime (08.00–18.00) and on Saturdays (08.00–12.00).

If working hours outside of those listed above are required, mitigation will be discussed with the Local Authority (Aberdeenshire Council) and any works outside of the pre-approved hours will not be undertaken prior to the appropriate permissions being granted. The process for updates and amendments to this CMS, outlined in Section 3, will be followed where appropriate.

Furthermore, should 24 hour operations be required for the cable installation works, AOWFL will contact Aberdeen City Council Environmental Health Service 21 days prior to the proposed out of hours work being undertaken to discuss the nature of works, potential mitigation and community liaison.

## 7 CONTRACTORS AND SUBCONTRACTORS

### 7.1 Introduction

AOWFL is the Principal Designer for the offshore components of the Development whilst J. Murphy & Sons Ltd. (Murphy) is the Principal Designer for the onshore components of the Development.

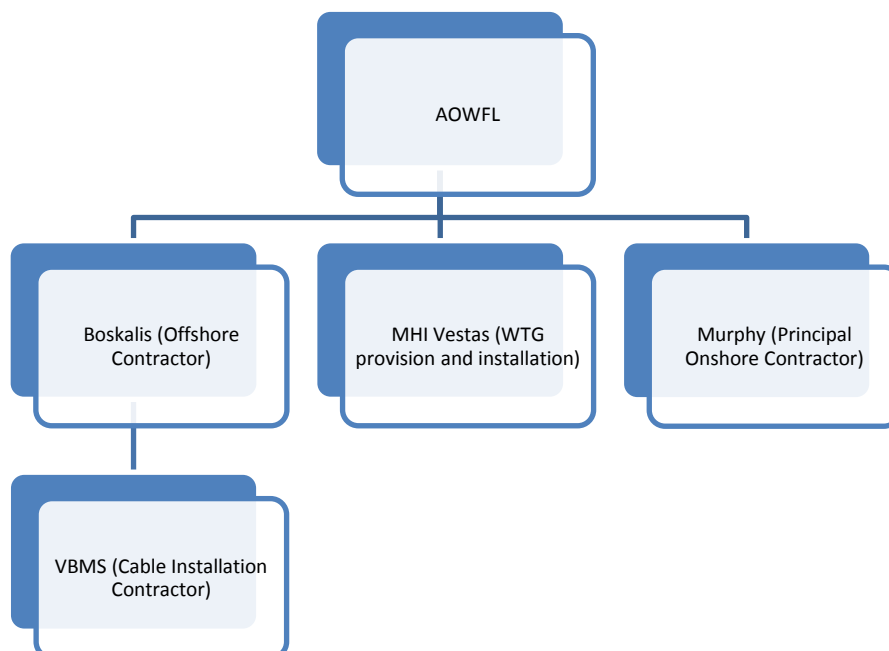
Murphy will undertake the onshore work on behalf of AOWFL, including the preconstruction design and onshore cabling and the construction of the substation.

AOWFL will undertake the overall project management of the Development, consent compliance responsibilities, contracting and management of contractors and overall HSSE responsibilities for the offshore works.

The Contractors and Subcontractors chosen to undertake the offshore works on behalf of AOWFL are detailed in Sections 7.2 and 7.3 and are summarised in Figure 13.

In line with the requirements of the Marine Licence (Conditions 3.1.2) the final identities of the persons responsible for making deposits, acting on behalf of the licensee, operators of vessels and vehicles, Contractors and Subcontractors will be notified to the Licensing Authority prior to their engagement in the works.

**Figure 13 Contractor and Subcontractor Organisational Chart**



## 7.2 Contractors

---

### 7.2.1 Boskalis

AOWFL has appointed Royal Boskalis Westminster N.V. (Boskalis) as the Contractor for EOWDC to install the offshore components of the works described in this CMS.

Boskalis offers a wide variety of maritime services and contracting to the offshore energy sector under the brands Boskalis, Dockwise, Fairmount and VBMS. These include the development, construction, transport, installation, inspection, repair & maintenance (IRM) and decommissioning of oil and LNG import/export facilities, offshore platforms, pipelines and cables and offshore wind farms.

Boskalis will be responsible for:

- Installation of the scour protection;
- Installation of the jackets with suction bucket foundations;
- Installation of the inter-array and offshore export cables (provided by VBMS);
- Installation of the WTGs;
- Provision of support vessels;
- Provision of survey services;
- Provision of transport services; and
- Identifying and contracting Subcontractors.

### 7.2.2 MHI Vestas Offshore Wind

MHI Vestas Offshore Wind (MVOW) is a joint venture between Mitsubishi Heavy Industries and Vestas Wynd Systems A/S.

MVOW has been contracted by AOWFL to supply the WTGs and commission and complete the WTGs offshore for the EOWDC.

## 7.3 Subcontractors

---

Contractors will be responsible for identifying and contracting Subcontractors such as may be required to provide services for the completion of the construction works. For instance cable installation will be undertaken by VBMS (a Boskalis subsidiary) with cables supplied by JDR Cable Systems Ltd.

Examples of other services that may need to be subcontracted include provision of support vessels, survey services, transport services, supply of minor components, waste services, vessel provisioning and bunkering services and provision of equipment to be used in the construction works.

## **8 MARINE COORDINATION AND VESSELS**

### **8.1 Marine Coordination**

---

AOWFL recognises that the extent of the marine coordination is critical to the control of the construction process. It will define all the requirements for the safe and effective working of the onshore and offshore construction sites, aiming to ensure the safety and security of all equipment, assets and personnel. Marine Coordinators shall be employed to ensure marine coordination is managed effectively.

The main topics for which detailed arrangements will need to be developed, communicated and audited include:

- Work Package Management;
- Marine Co-ordination Management;
- Weather Forecasting and Met Ocean Data;
- Navigational Marking;
- Vessel Chartering and Marine Support;
- Marine Logistics and Marshalling;
- Personnel Training and Certification; and
- Marine Co-ordination Centre.

Prior to and throughout the construction phase, a Marine Coordination Centre will be established at Aberdeen to control all offshore works and vessel movements.

### **8.2 Use of Dynamic Positioning and Safety/ Guard Vessels**

---

This section satisfies the requirements of S.36 Condition 13e) by outlining the use of dynamic positioning and safety / guard vessels during the construction of the EOWDC. It is anticipated that guard vessels will be used to monitor the safety zones and the buoyed construction area during certain stages of the construction phase. These vessels will be locally sourced, where possible, and will be of a relevant class to work within the Development.

Details of the construction and guard vessels in addition to the dynamic positioning that will be used to complete the construction works described in this CMS are presented for approval within the Vessel Management Plan (VMP) (EOWDC Document Reference: ABE-ENV-BD-0006) (required under Condition 24 of the S.36 Consent) and are outlined below.

## **9 POLLUTION PREVENTION MEASURES (INCLUDING CONTINGENCY PLANS)**

---

This section satisfies the requirements of S.36 Condition 13f) pertaining to:

*‘Pollution prevention measures including contingency plans’.*

A Marine Pollution Contingency Plan (MPCP) (EOWDC Document Reference No. ABE-ENV-QB-0004) will be submitted to MS-LOT for approval as a requirement of Condition 3.1.11 of the Marine Licence. The MPCP makes provisions in respect of spills and collision incidents occurring during the construction and operation of the Development.

All construction vessels will be required to comply with International Maritime Organisation (IMO) regulations and will follow The International Convention for the Prevention of Pollution from Ships (MARPOL) requirements regarding discharge of waste, sewage and oil or oily mixtures.

Waste from vessels will be handled according to the vessel’s Waste Management Plan. In the case of waste handling/disposal in ports, an official receipt or certificate will be handed by the approved waste transporter to the vessel for registration in the Garbage logbook.

Small workboats in the field will comply with local legislation, for example discharge of garbage in the port via an approved waste transporter.

All vessels will be equipped with Spill kits according to their Ship Oil Pollution Emergency Plan (SOPEP) and where necessary, additional equipment will be installed and will comply with the requirements set out in the approved MPCP. SOPEP drills will be carried out according to vessel drills schedule.

The details of the environmental management measures that will be applied by AOWFL and the Contractors and Subcontractors will therefore incorporate a variety of good working practice and be compliant with relevant legislative standards in relation to the control of waste, dropped objects, pollution prevention, chemical usage, etc. Environmental management measures are set out in the OEMP which will be applied in undertaking the proposed construction works set out in this CMS.

In addition to the OEMP, a number of other consent plans or requirements also incorporate matters related to environmental management (and incorporate elements of good working practice) including:

- The Vessel Management Plan (VMP) (EOWDC Document Reference: ABE-ENV-BD-006) – management of vessel operations to mitigate effects on environmental sensitivities;
- Construction Noise Management Plan (CNMP) (EOWDC Document Reference: ABE-ENV-DC-0005) – sets out airborne noise related construction procedures and good working practices in the installation of the EOWDC;

- The Navigational Safety Plan (NSP) (EOWDC Document Reference: ABE-ENV-QB-0008) – setting out procedures relating to navigational safety, promulgation of information and emergency response;
- The Navigational Marking Plan (NMP) (EOWDC Document Reference: ABE-ENV-BD-0009)– sets out the lighting and marking to mitigate against impacts on other sea users;
- The Cable Laying Strategy (CLS) (EOWDC Document Reference: ABE-DB-0003) – provides cable installation procedures including management of Electromagnetic Field attenuation; and
- Ecological Clerk of Works (ECOW) – environmental liaison.

## 10 DESIGN STATEMENT

---

S.36 Condition 13g) makes reference to the requirement for the CMS to include information relating to the Design Statement, *requiring:*

*The CMS must include, but not be limited to, information on the following matters:*

*(g) Design Statement*

A Draft Design Statement was submitted in 2016 to Marine Scotland Licensing and Operations Team and an updated Design Statement (EOWDC Document Reference: ABE-ENV-BD-0017) will be submitted, for approval, as a requirement of Condition 14 of the S.36 Consent. The Design Statement details:

- (a) Layout location for each phase and each turbine; and
- (b) Turbine height, finishes, blade diameter and rotation speed across each phase, rows and individual turbine locations; and
- (c) Lighting requirements (navigation and aviation) for each turbine / row; and
- (d) Further detailed assessment of visual impacts to inform the detailed layout and design of each location from selected viewpoints agreed with the Scottish Ministers and relevant stakeholders.

The Development will be constructed in accordance with the approved Design Statement and the construction methods detailed in this CMS will be compliant with the requirements of the approved Design Statement.

## 11 COMPLIANCE WITH APPLICATION AND ASSOCIATED ADDENDUM

### 11.1 Introduction

---

In addition to the conditions presented in Table 1, Condition 7 of the S.36 Consent states:

*“The Development must be constructed and operated in accordance with the terms of the Application and the accompanying Environmental Statement and the Supplementary Environmental Information Statement, except in so far as amended by the terms of the Section 36 consent and any direction made by the Scottish Ministers.”*

Section 11.2 sets out how the design parameters of relevance to the CMS complies with the Application, ES, SEIS and Annex 1 of the S.36 Consent letter.

Section 11.3 sets out that the commitments made in the Application, ES and associated Supplementary Environmental Information Statement (SEIS) will be delivered.

### 11.2 Compliance with the Construction Methods Assessed in the ES/SEIS

---

The ES and associated SEIS described a range of construction method options that could be applied during the construction of the Development.

Since the S.36 Consent and Marine Licences were awarded, the design of the Development and approach to installation has been substantially refined to that described in this CMS (and in other relevant Consent Plans). In order to demonstrate compliance of this refined design, installation methods and specifications described in the ES and associated SEIS are compared to the installation methods and specifications detailed within this CMS (see Appendix A).

### 11.3 Delivery of Construction-related Mitigation Proposed in the ES/SEIS

---

The ES and associated SEIS detailed a number of mitigation commitments relevant to the construction activities. Appendix B sets out where each commitment has been addressed within this CMS.



## 12 REFERENCES

---

Aberdeenshire Council (2011) Onshore Consent Planning Application No. APP/2011/2815.

AOWFL (2011) European Offshore Wind Deployment Centre Environmental Statement

AOWFL (2012) European Offshore Wind Deployment Centre Environmental Statement Addendum (SEIS).

AOWFL (2017) Cable Laying Strategy (EOWDC Document Reference Number ABE-ENV-DB-0003).

AOWFL (2017) Construction Noise Management Plan (EOWDC Document Reference: ABE-ENV-DC-0005).

AOWFL (2017) Navigational Marking Plan (EOWDC Document Reference: ABE-ENV-BD-0009).

AOWFL (2017) Navigational Safety Plan (EOWDC Document Reference: ABE-ENV-QB-0008).

AOWFL (2017) Vessel Management Plan (EOWDC Document Reference: ABE-ENV-BD-0006).

Marine Scotland (2013) Section 36 Consent Granted by the Scottish Ministers to Construct and Operate the European Offshore Wind Deployment Centre (EOWDC) Electricity Generating Station, Aberdeen Bay, Approximately 2 km East of Blackdog, Aberdeenshire.

Marine Scotland (2016) Marine Licence for Marine Renewables Construction Works and Deposits of Substances or Objects in the Scottish Marine Area. Reference 04309/16/1.

## APPENDIX A COMPLIANCE WITH ROCHDALE ENVELOPE PARAMETERS

Table A1 presents a comparison of consented parameters relevant to the construction methods, against the details set out in this CMS.

**Table A1- Comparison of construction methods detailed within the ES, SEIS, Marine Licence, S.36 and Marine Licence Application and the parameters detailed within this CMS.**

Construction Method	Rochdale Envelope Parameters	Parameters as detailed in the CMS
<b>WTG foundations</b>		
Foundation Types	Monopiles; Jackets Tripods Gravity base structure Suction caisson/ buckets	Suction bucket jackets
Foundation installation procedure	<ul style="list-style-type: none"> <li>•Float to location and ballast</li> <li>•Lift to location and ballast</li> <li>•Lift to location and secure to seabed</li> </ul>	Lift to location and secure to seabed.
Maximum diameter for suction bucket foundations	Maximum suction bucket diameter: 20 m Suction bucket penetration (below seabed): up to 18 m	Maximum suction bucket diameter: 9.5 – 10.5 m Suction bucket penetration (below seabed): up to approximately 15 m
<b>WTGs</b>		
Number of WTGs	Not more than 11	11
WTG Tip height range	Up to 198.5 m	Up to 191 m above LAT
WTG Hub height range	Up to 120 m	109 m above LAT
Number of Rotor Blades	3	3
Lowest point of rotor swept above MHWS	22 m	22 m
WTG Maximum rotor diameter	172 m	164 m
Minimum spacing	790 m (indicative minimum spacing)	814 m
<b>Cables</b>		
Number of OEC cable trenches	4	2
Maximum length of Offshore Export Cables	26 km	Up to ~8 km
Maximum length of Inter-array cables	13 km	~9.7 km
Maximum cable core cross section of Offshore Export Cables	800 mm <sup>2</sup>	400 mm <sup>2</sup>
Maximum cable core cross section of Inter-array cables	800 mm <sup>2</sup>	400 mm <sup>2</sup>

Construction Method	Rochdale Envelope Parameters	Parameters as detailed in the CMS
Maximum width of cable trench	10 m	Dredged trench for duct extension (option): ~8 m wide
Depth of cable trench	0.6 m -3 m	Indicative target burial depth of up to 1.5 m for OECs and 1.0 m for the Inter-array cables.
Maximum number of cables per trench	1	1
Landfall installation method	Horizontal Directional Drilling (HDD) Dredged Cofferdam/ Open trenching Plough pulled off the beach	The following methods are considered as options: <ol style="list-style-type: none"> <li>1. Onshore duct, crossing the Blackdog Burn (approx 150 m) and float in</li> <li>2. Onshore duct (approx 150 m) and duct extension (approx 850 m)</li> </ol>
Cable burial method	Ploughing Jetting Mass flow excavation	<ul style="list-style-type: none"> <li>• Cutting and Jetting</li> <li>• Dredging with Backhoe dredger</li> <li>• Jetting</li> <li>• Mass flow Excavation</li> </ul>
Specification of cables	33 kV Alternating Current (AC) cables	66 kV AC cables. Note that AOWFL proposes to use 66 kV cables rather than the 33 kV cables that were described in the ES and SEIS. Section 12.4 of the CLS provides further detail on the consultation that has been undertaken in relation to this change and specifically in relation to EMF effects.
Protection method	Burial Concrete mattresses	<p>AOWFL commits to re-bury any cable potentially re-exposed by erosion and confirms that it is AOWFL's intention to bury all of the Offshore Export Cables and Inter-array cables, as described in section 9 of the Cable Laying Strategy, and the need for additional protection is not currently anticipated along the main cable lengths.</p> <p>In the unlikely event that the cables cannot be buried to a depth sufficient to provide adequate protection due to, for example, unexpected ground conditions,</p>

Construction Method	Rochdale Envelope Parameters	Parameters as detailed in the CMS
		additional cable protection may be required along those sections where inadequate burial is achieved. In this unlikely scenario, the Licensing Authority, SNH, NLB and the MCA will be informed and further details on the proposed additional cable protection would be provided.
<b>Scour protection</b>		
Volume of scour protection (Stone/Rock/Gravel)	35,750 m <sup>3</sup>	Not expected to exceed 35,750 m <sup>3</sup>
<b>Timescales for construction</b>		
Landfall works	Construction activity is expected to continue, subject to site weather conditions, for 24 hours per day until construction is complete and may take place at all times of the year.	<p>The anticipated working hours for construction phases are detailed in the CNMP (ABE_ENV_DC_0005) and outlined below:</p> <ul style="list-style-type: none"> <li>• All offshore activities: working hours will be 24 hours, 7 days a week;</li> <li>• Working hours for the export cable installation trenching operations (located landward of the beach) at the landfall location are expected to be during the daytime (08.00–18.00) and on Saturdays (08.00–12.00).</li> </ul> <p>If working hours outside of those listed above are required, mitigation will be discussed with the Local Authority and any works outside of the pre-approved hours will not be undertaken prior to the appropriate permissions being granted.</p>
Pile Driving	5 hours per foundation. Daytime hours only.	No piling will be undertaken.
Installation of foundations	Construction activity is expected to continue, subject to site weather conditions, for 24 hours per day until construction is complete and may take place at all times of the year.	For all offshore activities working hours will be 24 hours, 7 days a week.
Installation of offshore export cables	Construction activity is expected to continue, subject to site weather conditions, for 24 hours per	Working hours for the cable installation activities at the Offshore Export Cable Corridor Landfall are expected to be 12 hours, 7 days a

Construction Method	Rochdale Envelope Parameters	Parameters as detailed in the CMS
	day until construction is complete and may take place at all times of the year.	week.
Installation of Inter-array cables	Construction activity is expected to continue, subject to site weather conditions, for 24 hours per day until construction is complete and may take place at all times of the year.	For all offshore activities working hours will be 24 hours, 7 days a week.
Installation of WTGs	24 hours a day	For all offshore activities working hours will be 24 hours, 7 days a week.

## APPENDIX B COMPLIANCE WITH MITIGATION MEASURES

Table B1 presents the commitments made by AOWFL in the ES and associated SEIS to mitigation measures relevant to this CMS.

**Table B1- ES and SEIS Construction related mitigation relevant to this CMS**

Source and Reference	Details of Commitment	Implementation
ES - Project Description	Cables would be buried in the seabed to a sufficient depth, which would be determined by a burial protection study. Typical burial depths would be in the range of 0.6 m – 3 m.	Indicative target burial depth is up to 1.5 m for OECs and 1.0 m for the Inter-array cables. (Sections 9 and 10 of the CLS.)
ES - Project Description	Cable Installation All the subsea cables would be buried in order to provide protection from all forms of hostile seabed intervention, such as fishing activity (trawler and otter boards), dragging of anchors and the minor risk of dropped objects. The subsea cables are also buried to ensure stability in the tidal conditions and eliminate the risk of free-spans causing cable fatigue.	All cables will be buried where possible. (Sections 9 and 10 of the CLS.)
ES- Marine Ecology, Intertidal Ecology, Sediment and Water Quality	Noise mitigation for underwater noise and vibration impacts on fish at source (e.g. softstart procedure).	Piling is no longer a method under consideration and as such softstart procedures are no longer required. Construction methods are outlined in Section 5 of this CMS.
ES- Ornithology	Minimise vessel movements and use existing shipping routes as far as practicable.	Vessel movements and management are discussed in the VMP and NSP.
ES- Ornithology	Minimise as far as practicable significant piling operations during periods of high seabird sensitivity.	Piling is no longer a method under consideration. Construction methods are outlined in Section 5 of this CMS.
ES- Ornithology	Minimise use of lights	Marine and aviation marking, including lights, visual marks, and construction buoyage will be provided in accordance with NLB, and CAA requirements. Detailed information relating to lighting and marking of the EOWDC during the construction phase is set out in the NMP.
ES- Marine Mammals	Marine Mammal Protection Plan (MMPP) Including piling mitigation measures; soft – start Marine Mammal Observers, Passive Acoustic Monitoring (PAM).	Piling is no longer a method under consideration and as such mammal mitigation measures including soft start procedures are no longer required.

Source and Reference	Details of Commitment	Implementation
		Construction methods are outlined in Section 5 of this CMS. The OEMP contains information pertaining to marine mammals and a MMPP.
ES- Shipping and Navigation	Appropriate liaison to ensure information on the wind farm and special activities is circulated in Notices to Mariners, Navigation Information Broadcasts and other appropriate media.	Information pertaining to promulgation of information (including Notice to Mariners (NtMs)) is included in the NSP.
ES- Shipping and Navigation	Structures to be marked and lit in-line with Northern Lighthouse Board and International Association of Marine Aids to Navigation and Lighthouses (IALA) guidance.	Section 9 of the NMP details navigational marking during construction: temporary lighting and marking; buoyage; and, vessel safety requirements.
ES- Shipping and Navigation	The construction area and incomplete structures would be lit and marked in accordance with the protocol recommended by THLS.	Section 5.2 of the NSP
ES- Shipping and Navigation	Lowest point of rotor sweep at least 22 m above Mean High Water Springs as per RYA and MCA recommendations.	Appendix A of this CMS.
ES- Shipping and Navigation	Cables to be buried to suitable depth based on cable protection study taking into account fishing and anchoring practices in Aberdeen Bay. Periodic inspection of the cable to ensure it remains buried. Positions of cable routes notified to Kingfisher Information Services (KIS) for inclusion in cable awareness charts and plotters for the fishing industry.	Outlined in Section 9 of the CLS.  Outlined in Section 9 of the Navigational Safety Plan.
ES- Shipping and Navigation	The Applicant would use the draft template created by the MCA to formulate an emergency response plan and site Safety Management Systems, in consultation with the MCA.	Outlined in Section 10 of the NSP.
ES- Commercial Fisheries	Contractors' obligations and standard offshore practices would prevent, or in case of accidental incidents, remove dropped objects	Outlined in the Environmental Management Framework section of the OEMP
ES- Commercial Fisheries	Safety issues for fishing vessels (collision with construction vessels) - Implementation and adherence to standard offshore safety procedures. Involvement of the SSF for liaison and information distribution.	Outlined in Section 9 of the NSP. Scottish Fishermen Federation included in the NtM distribution list.
ES- Marine and Maritime Archaeology	Avoidance, where practicable, is the preferred mitigation strategy for known cultural heritage assets. Minor amendments to the position of cable trenching and the configuration or placement of the foundation of WTG 8 (now called AWF07) were made prior to the submission of the ES. Best practice and effective monitoring may be partly achieved by implementing the Crown Estate reporting protocol. An Archaeological Plan will be included in the Offshore Environmental Management Plan (OEMP).	The final WTG layout has taken account of archaeological assets. Amendments to cable trenching position also made prior to ES being submitted. An Archaeological Plan will be produced in accordance with the Crown Estate reporting protocol.

Source and Reference	Details of Commitment	Implementation
ES- Salmon and Sea Trout	Soft-start piling and installation schedule to be discussed with relevant Stakeholders and regulators	Installation mitigation no longer required as piling will not be undertaken (see Section 5 for installation techniques).
ES- Salmon and Sea Trout	Cables will be buried	Indicative target burial depth is up to 1.5 m for OECs and 1.0 m for the Inter-array cables. (Sections 9 and 10 of the CLS).
ES- Salmon and Sea Trout	Liaison and consultation with relevant stakeholders	Outlined in OEMP.
ES- In Air Noise	Sleep disturbance during piling at night- No piling during night Stress, annoyance during piling daytime- Screens and good information policy	Installation mitigation no longer required as piling will not be carried out (see Section 5 for installation techniques).