

Development Specification and Layout Plan Doc. No.:

KOWL-PL-0004-011

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# DEVELOPMENT SPECIFICATION AND LAYOUT PLAN KINCARDINE OFFSHORE WINDFARM PROJECT

Prepared	Checked	Reviewed	Approved
27/04/2018	01/05/2018	02/05/2018	02/05/2018
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#### **Revision History**

Date	Rev. Status	Purpose of Issue*	Remarks	Initials
21-03-2018	A1	Internal Review		MB
22-03-2018	B1	External Review	Issued for External Review	JD
27-04-2018	C1	For Information	-	AC

<sup>\*</sup>Purpose of Issue: for information, for review, for approval



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## **Detailed Change Log**

Date	Rev. Status	References	Description of changes	Initials
22-03-2018	A1	CRS	See Comments Review Sheet	JD
27-04-2018	C1	-	Logo change, minor text changes, updated image	AC



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#### **ACROYNMS, ABBREVIATIONS and DEFINITIONS**

ALARP	As Low As Reasonably Practical
CaP	Cable Plan
DS	Design Statement
DSLP	Development Specification and Layout Plan
HDD	Horizontally Directional Drill
KOWL	Kincardine Offshore Wind Farm Limited
LMP	Lighting and Marking Plan
m	Metre
MCA	Maritime and Coastguard Agency
MS-LOT	Marine Scotland Licensing Operations Team
MW	Mega Watt
nm	Nautical Mile
OREI	Offshore Renewable Energy Installation
S	Second
S36C	Section 36 C Variation Application to vary the Section 36 Consent granted to KOWL in March 2017
UKHO	United Kingdom Hydrographic Centre
UXO	Unexploded Ordnance
WROV	"Work Class" Remotely Operated Vehicle



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#### 1. INTRODUCTION

#### 1.1. Purpose of the Document

This document has been authored to satisfy Condition 11 of the Section 36 Consent issued to Kincardine Offshore Windfarm Ltd (KOWL) for the Kincardine Offshore Windfarm (the Project). This document provides the current (at the time of writing) Development Specification and Layout Plan (DSLP) proposed for the Project, (see Section 1.5 for the wording of the condition), which requires the submission of a DSLP no later than six months prior to the Commencement of the Development

#### 1.2. Scope of the Document

This document outlines the indicative location and design parameters of the Project including, coordinates of the turbines and substructures, dimensions of the turbines, lighting and markings and cables, both inter-array and export cables. This document also supports the Design Statement (Condition 12 of the Section 36 Consent – see Section 1.5 for further details), and is informed by the Lighting and Marking Plan (Condition 18 of the of the Section 36 Consent – see Section 1.5 for further details).

#### 1.3. Project Overview

The Project is considered a commercial demonstrator site, which will utilise floating foundation technology, and will be one of the world's first arrays of floating wind turbines. It has been included within the Survey, Deploy and Monitoring scheme for offshore renewable systems (similar to wave and tidal devices).

The Project is located south-east of Aberdeen approximately 8nm (15km) from the Scottish coastline, in a location that provides suitable water depth for a floating offshore wind demonstrator development (approximately 60-80m) (Figure 1-1).

The project is split into the following areas:

- The Development Area the wind farm area including the Wind Turbine Generators (WTG) and inter-array cables.
- The Offshore Export Cable Corridor the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the onshore area at Mean High Water Spring (MHWS).
- The Onshore Area the onshore area above MHWS including the underground cables connecting to the onshore substation at Redmoss.

This DSLP focuses on the offshore elements only as per Section 36 Consent and Marine Licences granted.

In April 2016 KOWL submitted applications for consent to construct and operate the Project, which included the Original ES. In September 2016 an addendum (referred to as the ES Addendum), of additional environmental information to the Original ES, was also submitted. In March 2017 consent under Section 36 and Section 36A of the Electricity Act 1989 was granted.

Since consent was granted, there have been several necessary changes to the Project. Therefore, an application for a variation of the Section 36 consent granted by the Scottish Ministers under S36C of the Electricity Act 1989 was applied for in December 2017 (the 'Variation Application').



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The table below outlines the application dates, relevant ES Documents and the components of the Project as were included in the Original Application and the Variation Application.

Table 1-1 Summary of document timelines

Original Documents	Addendums	Variation
Date Submitted: March 2016	Date Submitted: September 2016	Date Submitted: November 2017
Original Application	Original Application	S36C Variation Application
Kincardine Offshore Windfarm ES (Original ES)	ES Additional Information Addendum (ES Addendum)	Section 36C Variation ES (Variation ES)
Maximum generation capacity: 50MW	Maximum generation capacity: 50MW	Maximum generation capacity: 50MW
WTGs: 8 x 6MW	WTGs: 8 x 6MW	WTGs: 1 x 2MW and 6 x 8.4MW
Substructures: semi- submersible	Substructures: semi-spar	Substructures: combination of semi-submersible and semi-spar
Cables: 33kv inter-array and export cables	Cables: 33kv inter-array and export cables	Cables: 33kv inter-array and export cables

#### **Project Components**

As noted in the table above, the maximum generation capacity of the windfarm is capped at 50MW, the main difference between the various stages of the applications have been the number and size of the turbines, and the substructure type.

As applied for in the Variation Application, the Project will now consist of the following offshore components:

- WTGs: 1 x 2MW and 6 x 8.4MW
- Substructures: semi-submersible Windfloat™ design
- 33kv inter-array and two export cables

Onshore, the following construction activities will also take place (under permissions granted by Aberdeen City Council):

- Onshore substation
- Horizontal Directional Drilling landfall and onshore cable route.



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The first WTG to be deployed will be a WTG and associated substructure, anchors and mooring lines with a generating capacity not exceeding 2MW ('Turbine 1'), A condition in the existing marine licence requires Third Party Certification or Verification (or suitable alternative as agreed, in writing, with the Licensing Authority) for all WTGs, mooring systems and WTG platform structures prior to the commencement of the works. The initial period sought for such certification / verification / suitable agreed alternative of the WTG platform substructure for Turbine 1 will be limited (expected to be three years or less). This is due to the engineering life of the substructure (ten years from initial substructure construction in 2011). At the expiry of the WTG platform substructure certification, Turbine 1 will only be re-deployed if (i) the platform structure is re-certified following inspection (and only for so long as valid certification is in place) and (ii) if MS-LOT (in consultation with SNH, Historic Environment Scotland, Aberdeen City Council and Aberdeenshire Council) is satisfied that the re-deployment at the proposed location within the Site would not give rise to new or materially different likely significant effects to those identified in the seascape, landscape and visual assessment of the Variation ES. Any further re-certification would follow the same process. If Turbine 1 is not re-deployed within 6 months, it will be decommissioned (in line with condition 5 of the S36 consent on Redundant turbines). It is anticipated this position will be secured by a condition in the marine licence (and if considered necessary, also in the S36 consent).

#### **Construction Programme Overview**

The construction of the Project is anticipated to occur in 'Tranches' in-line with the indicative Programme outlined below. A final Construction Programme for each tranche will be provided to Scottish Ministers prior to commencement of the construction as a requirement of the consent conditions.



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Table 1-2 Indicative construction programme

Tranche	Activities	Indicative Start Dates
	Onshore works and HDD drilling	March 2018
Tranche 1	Mooring installation Turbine Location 1	May 2018
Tranche i	Export Cable 1 installation	May 2018
	Installation of 2MW turbine to Location 1	June 2018
	Export Cable 2 installation	April 2019
Tranche 2	Mooring installation Turbine Locations 5-7	April 2019
Trancile 2	Installation of inter-array cables Locations 5-7	Aug 2019
	Installation of turbines to Locations 5-7	Aug 2019
	Mooring installation Turbine Locations 1-3	March 2020
	Installation of inter-array cables Locations 1-3 and 8	June 2020
Tranche 3	Move 2MW to Location 8 (dependent on recertification and consultation as noted above)	June 2020
	Installation of turbines to Locations 1-3	June 2020

Please note, Export cable 2 may be installed as part of Tranche 1; however, at the time of writing this DSLP the timing was still to be decided. This will be confirmed in due course, and this document updated if required as per Section 1.4 below.



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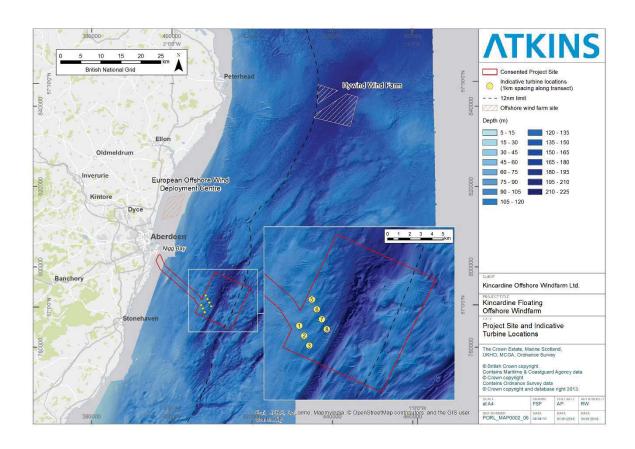


Figure 1-1 Project Site and Indicative Turbine Locations

#### 1.4. Approach to Amending and Updating this DSLP

This is the first iteration of the DSLP (submitted pre-installation of the initial turbine on site). The nature of the construction process proposed for Project, see Section 4.2 for full details) means that there may be further changes to the possible layout of the moorings, Export Cable 2 and the inter-array cables. Furthermore, the 2MW turbine may also be deployed in two different locations (1 and 8 in Figure 1-1) Therefore, two layouts have been provided as part of the this DSLP in Appendix A and Appendix B. The first (Appendix A) is the layout plan for the 2MW deployment only with the export cables; and the second (Appendix B) for the possible likely final configuration (2MW turbine in Location 8 and the six larger turbines, both export cables and the inter-array cables) as presented in the visualisations that were assessed in the Seascape, Landscape Visual Impact Assessments Section of the Variation ES (see Section 5 and Appendix A of the Variation ES).

The nature of the construction process proposed for the Project (see Section 1.3 for details) means that updates to this document will be required as the Project progresses which is in line with the approach agreed with MS-LOT.

Where the need for an update or amendment is identified following approval from Marine Scotland Licensing Operations Team (MS-LOT) of the DSLP, either through a consultation response, or due to practicalities arising as the project progresses, KOWL will communicate the suggested update/amendment to MS-LOT prior to editing the approved document. If the suggested change is accepted by MS-LOT, the DSLP will be redrafted, and submitted for re-approval.



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It is anticipated that the DSLP will be reviewed at least at the following times:

- 6 months prior to Commencement Tranche 2; and
- 6 months prior to Commencement Tranche 3.

#### 1.5. Consent Conditions

The following consent condition is taken from the Section 36 Consent which forms the requirements for this DSLP.

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Table 1-3 Licence conditions relevant to the DSLP

Licence	Licence Condition Number	Name	Details	Where Addressed in this Document
S36	11	Development	The Company must, no later than 6 months prior to the	
		Specification	Commencement of the Development or at such a time	
		and Layout	as agreed with the Scottish Ministers, submit a Design	
		Plan	Specification and Layout Plan ("DSLP"), in writing, to	
			the Scottish Ministers for their written approval. Such	
			approval may only be granted following consultation by	
			the Scottish Ministers with SNH, MoD, SFF, JRC,	
			CAA, ACC, AC, MCA, NLB, NATS, and any such other	
			advisors or organisations as may be required at the	
			discretion of the Scottish Ministers.	
			The DSLP must include, but not be limited to:	
			a. a plan showing the location of each individual	
			WTG (subject to any required micro-siting),	a. plans are provided in Appendix A and B
			including information on WTG spacing, WTG	
			identification/numbering, seabed conditions,	
			bathymetry, confirmed foundation type for	
			each WTG and any key constraints recorded	
			on the Site;	
			b. a list of latitude and longitude co-ordinates	
			accurate to three decimal places of minutes of	
			arc for each WTG. This should also be	b. provided in Section 2.3
			provided as a Geographic Information System	



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t. Provided in Section 2.7 and 2.8	seabed of all inter-array cables.		
	f. the length and proposed arrangements on the		
e. Provided in Section 2.6	on WTG lighting and marking); and		
	e. the finishes for each WTG (see condition 18		
	generating capacity for the Site overall;		
	the Site (Annex 1, Figure) and a confirmed		
d. Provided in Section 2.5	d. the generating capacity of each WTG used on		
	speed;		
	shaft), rotor diameter and maximum rotation		
	above LAT to the centreline of the generator		
	the highest point, height to hub (measured		
	above Lowest Astronomical Tide ("LAT")) to		
c. Provided in Section 2.4	including - height to blade tip (measured		
	c. a table or diagram of each WTG dimensions		
	System 1984 ("WGS84") format;		
	("GIS") shapefile using the World Geodetic		



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## **Linkages to Other Consent Plans**

The following consent condition is taken from the Section 36 Consent with which this DSLP has linkages to.

Table 1-4 Licence conditions linked to the DSLP

Licence	Condition Number	Name	Details
Section 36	12	Design Statement	The Company must, no later than 6 months prior to the Commencement of the Development, submit a Design Statement ("DS"), in writing, to the Scottish Ministers. The DS, which must be signed off by at least one qualified landscape architect as instructed by the Company prior to submission to the Scottish Ministers, must include representative wind farm visualisations from key viewpoints as agreed with the Scottish Ministers, based upon the final DSLP as approved by the Scottish Ministers as updated or amended.



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#### 2. DEVELOPMENT SPECIFICATION AND LAYOUT PLAN DETAILS

#### 2.1. Layout Plans

In Appendix A and Appendix B two layout plans are provided;

- Appendix A shows the plan for the 2MW turbine and substructure, Export Cable 1, and Export Cable 2 (KOWL-DR-0001-001 1 of 2 and 2 of 2)).
- Appendix B shows the final layout plan for the whole Project including the 2MW turbine and substructure, the six larger turbines, both export cables and the inter-array cables (KOWL-DR-0001-002 1 of 2 and 2 of 2)).

In each plan the following is provided in line with the wording of the consent condition:

- The location of each turbine:
- Details on spacing between each turbine (where relevant);
- Turbine numbering;
- Seabed conditions;
- Bathymetry;
- Foundation type (in this case number of mooring lines and anchor position); and
- Key constraints on the Site.

Further information is also provided on the bathymetry at the site, seabed conditions and key constraints of the site.

The remaining information requested in the Consent Condition is presented in the following sections.

#### **Seabed Conditions**

The seabed type varies along the Offshore Export Cable Corridor but is predominately sand overlaying a range of gravel and clay substrates. There are sections along the route which have boulder clays which may present challenges for trenching and are identified in the figure below (and is also shown in Appendix A-1 and Appendix A-2) in pink as "Fine to medium SAND with occasional boulders.

The seabed type in the Development Area is also predominantly loose medium sand overlaying dense to very dense medium sand, with some clay deposits also presents.

#### **Site Constraints**

The principal constraints on the site are illustrated in the figure below and also in the drawing presented in Appendix A;

- Consented Project Site As defined in the S36 Consent and Marine Licence
- Survey Extents As surveyed in the offshore campaigns
- The Crown Estate Scotland Lease Area Boundary a reduced area within the consented Project Site focused around the locations the turbines will be positioned in
- Identified wreck sites as confirmed in the geophysical survey



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#### **Bathymetry**

The water depth along the Offshore Export Cable Corridor varies from circa 20m (nearshore) to approximately 70m within the Development Area. Detailed bathymetry from the Export Cable Corridor is illustrated in Figure 2-1 (N.B. the surveyed area shown in the figure below is bigger than the consented area).

The water depth in the Development Area varies from approximately 68 - 72m. The bathymetry in the Development Area is shown below.



Figure 2-1 Detailed bathymetry of the Export Cable Corridor



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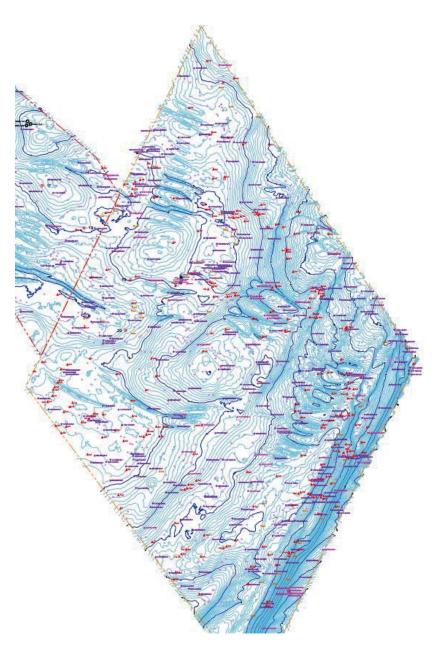


Figure 2-2 Detailed bathymetry of surveyed area within the Development Area



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#### 2.2. Substructure Type and Moorings

#### 2MW Turbine

As noted in the S36C Variation ES and the DS the substructure to be used for the 2MW turbine will the semi-submersible Windfloat™ design.

#### 8.4MW Turbines

The type of substructure to be used for the larger turbines is still under development, but it is currently understood that all the substructures will be the semi-submersible WindFloat design. This will however, be confirmed in a future iteration of this DSLP before Tranche 2 commences.

#### **Moorings and Anchors**

As per the moorings and anchors described and assessed in the Original ES, ES Addendum and Variation ES, the 2MW turbine and substructure will have four mooring lines and drag embedment anchors (12T Stevshark) will be used. The orientation of the mooring lines is shown in the drawings provided in Appendix A.

The number of mooring lines and anchors for the larger turbines will be confirmed prior to Tranche 2, however, it is still anticipated that only three mooring lines will be required, and that drag embedment anchors will be used.

#### 2.3. Co-ordinates

#### **Centre Point of Each Turbine Locations**

As noted in the LMP, ID markings for the turbines will be fixed per Site (rather than per individual turbine), and therefore ID boards will be transferable between turbines should they change location so that the positions noted below will always align with charts and emergency documentations. The coordinates of the centre point for each location are provided in Table 2-1 below. These locations are shown in the Final Layout Plan shown in Appendix B. The spacings between the turbines is also shown in Appendix B (drawing 2 of 2) and Figure 2-3 below.

Table 2-1 Coordinates of each turbine location centre point

	UTM ZONE 30		WGS84	
WTG	Easting (m)	Northing (m)	Latitude	Longitude
KIN-01	567912	6318507	57° 0' 18.281"	-1º 52' 54.792"
KIN-02	568417	6317644	56° 59' 50.109"	-1º 52' 25.71"
KIN-03	568878	6316758	56° 59' 21.214"	-1° 51' 59.269"
KIN-05	569056	6320921	57° 1' 35.724"	-1º 51' 44.619"
KIN-06	569517	6320035	57º 1' 6.828"	-1º 51' 18.166"
KIN-07	569979	6319148	57° 0' 37.897"	-1º 50' 51.666"
KIN-08	570441	6318260	57º 0' 8.931"	-1° 50' 25.179"



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A GIS shapefile with the centre locations listed above has also been provided to accompany this document which makes up the final configuration of turbines as presented in Appendix B, and aligns with the Variation ES and DS.

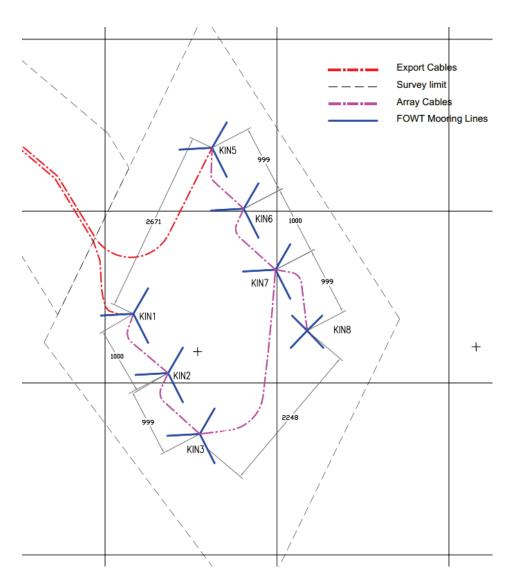


Figure 2-3 2MW and six 8.4MW turbine final layout plan showing spacing between the turbines



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#### **Centre Point of 2MW Anchor Locations**

As shown in Appendix A-1, the 2MW turbine and substructure will have four mooring lines and anchors. The centre point co-ordinates for the anchors are provided below. A GIS shapefile with the centre locations of the 2MW in location 1 and the four anchor points has also been provided to accompany this document. This is the as per the Tranche 1 Layout Plan shown in Appendix A.

The co-ordinates of the anchors for the larger turbines will be confirmed prior to Tranche 2.

Table 2-2 Coordinates of each anchor centre point for the 2MW turbine and substructure

	UTM ZONE 30		WGS84	
WTG	Easting (m)	Northing (m)	Latitude	Longitude
KIN-01 – ML1	568130	6318724	57° 0' 25.182"	-1º 52' 41.664"
KIN-01 – ML2	567693	6318724	57° 0' 25.412"	-1º 53' 7.559"
KIN-01 – ML3	567674	6318257	57° 0' 10.324"	-1º 53' 9.139"
KIN-01 – ML4	568149	6318257	57° 0' 10.072"	-1º 52' 40.991"

#### 2.4. Turbine Dimensions

The dimensions of each of the two turbines types to be used for the Project are summarised below. It is not anticipated that the dimensions for the larger turbines will change prior to Tranche 2 which is why both have been confirmed at this point. However, if there are any changes, this will be confirmed and updated proper to commencement of the tranche.

Table 2-3 2MW and 8.4MW turbine dimensions

WTG	Vestas V80	Vestas V164
Height of blade tip above water surface	106m	191m
Height of the hub above water surface	66m	104.9m
Rotor diameter	80	164m
Maximum rotation speed	17rpm	12.1rpm

#### 2.5. Generating Capacity

The table below outlines the generating capacity of each turbine type and the overall capacity of the Project is confirmed below. It is noted that the overall capacity of the individual turbines is greater than 50MW, however, the turbines will be rated to ensure the overall capacity of the Project will not be greater than 50MW.



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Table 2-4 Generating Capacity of the individual turbine and whole Project

Details	Generating Capacity	
Vestas V80	2MW	
Vestas V164	8.4MW	
Whole Project	50MW	

#### 2.6. Finishes of the Turbine

The markings to be used on the turbines and substructures have been defined in the LMP. A summary of those relevant to the DSLP has been provided below, the markings will be the same for the 2MW and the larger turbines, and for the different substructures that may be used.

#### **ID Markings**

Each turbine will be assigned a unique ID which will be displayed using painted IDs on the substructure columns and also identification panels fitted to the turbines, with the alphanumeric characters visible from 150 metres (m) away (typically at least 1m in height), and shown in black over a yellow background. Multiple illuminated panels will be used per turbine to ensure the ID is clearly visible in all directions, and during both the daylight and night hours.

Marking the substructures with painted IDs, rather than boards, has been undertaken as the substructure have no attachment points for boards that are considered safe from the impact are very large waves and therefore painted IDs are considered to be more appropriate for marking of the substructures. All substructure IDs will be clearly visible from 150 m away and will be lit as per MGM 543.

#### Paint

The turbine structure (columns) will be painted yellow (RAL 1023) in lead free pigmentation from the water line (float line) to a minimum of 9.5m up to the hand rails on the turbine structure. The portion of structure painted yellow may extend above 9.5m depending on ballast conditions, engineering requirements and the design of future phases of turbines. Sections of structure that will remain below Lowest Astronomical Tide at all times are not required to be painted. The remainder of the structure above the yellow paint will be painted light grey (RAL 7035) in lead free pigmentation.

#### Signage

Warning signs will be fitted to all sub-structures indicating the presence of subsea infrastructure (including mooring lines).

The relevant stakeholders will be made aware of the presence of cables, mooring lines, and other subsea infrastructure via various means including Notice to Mariners. This will include details of the intended installation dates.



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Temporary buoyage may also be used to mark any subsea infrastructure that poses a temporary hazard to passing traffic prior to turbine installation (noting a guard vessel may also be used for this purpose in addition to, or instead of temporary buoyage). This will be agreed with the NLB in advance of implementation.

#### **Blade Marking**

For the purposes of SAR operations, Annex 5 of MGN543 (MCA, 2016) requires the marking of all turbine blades with hover reference marks. In line with this guidance, the trailing edge of each blade will have three red marks at points 10, 20, and 30m from the hub end. These marks will have a minimum diameter of 600 millimetres. In addition, the tip of each blade will be painted red, up to a distance of approximately 2% of the total blade length. An indicative blade marking plan is presented in Figure 2.4

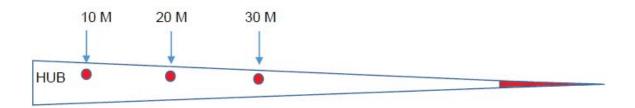


Figure 2-4 Indicative Blade Marking

#### **Nacelle Marking**

The ID number of each turbine will be clearly displayed on the roof of the nacelle, ensuring SAR helicopters can visually identify any given structure. The ID numbers will be as large as is reasonably practicable, but not less than 1.5m in height, and will be displayed on each turbine such as to be recognisable from an aircraft flying at a height of 150m above the highest point of the structure.

#### 2.7. Export Cables

The proposed routes for the export cables are shown in Appendix A-2 below. The lengths are provided in the table below. Further detailed of the export cables is provided in the Cable Plan (CaP).

Table 2-5 Length of Export Cable 1 and 2

Export Cable Number	Length (m)
Export Cable 1	17,100
Export Cable 2	18,500

#### 2.8. Inter-array Cables

The inter-array cables will only be installed prior to Tranche 2. The layout provided in the Appendix A-2 is only indicative at this stage, and a final layout will be provided prior to the commencement of Tranche 2. There is a total of six inter-array cables, five of which are approximately 1.2km in length and a single cable of approximately 3km in length. It should be noted that the cables will be in a buoyant wave configuration prior to entering the turbine and hence the plan distance of the cable route



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will be slightly less. The exact length of each cable will be confirmed once the final seabed microrouting has been completed.



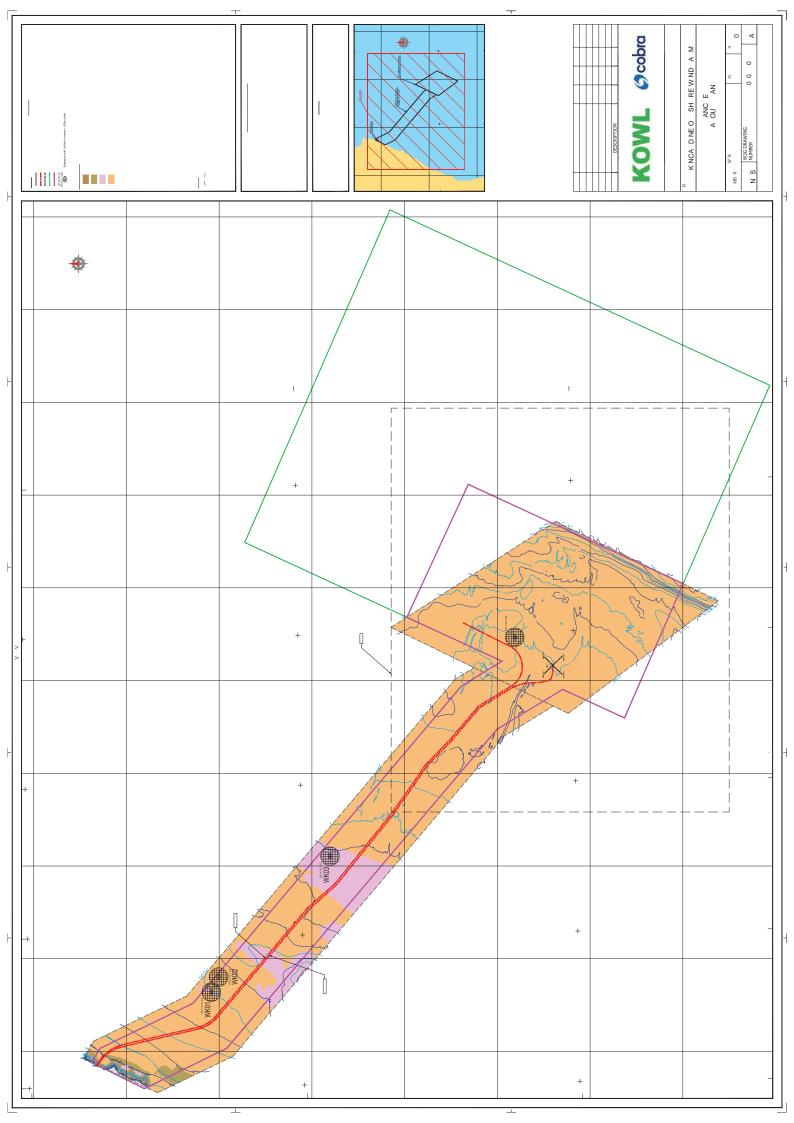
# DEVELOPMENT SPECIFICATION AND LAYOUT PLAN

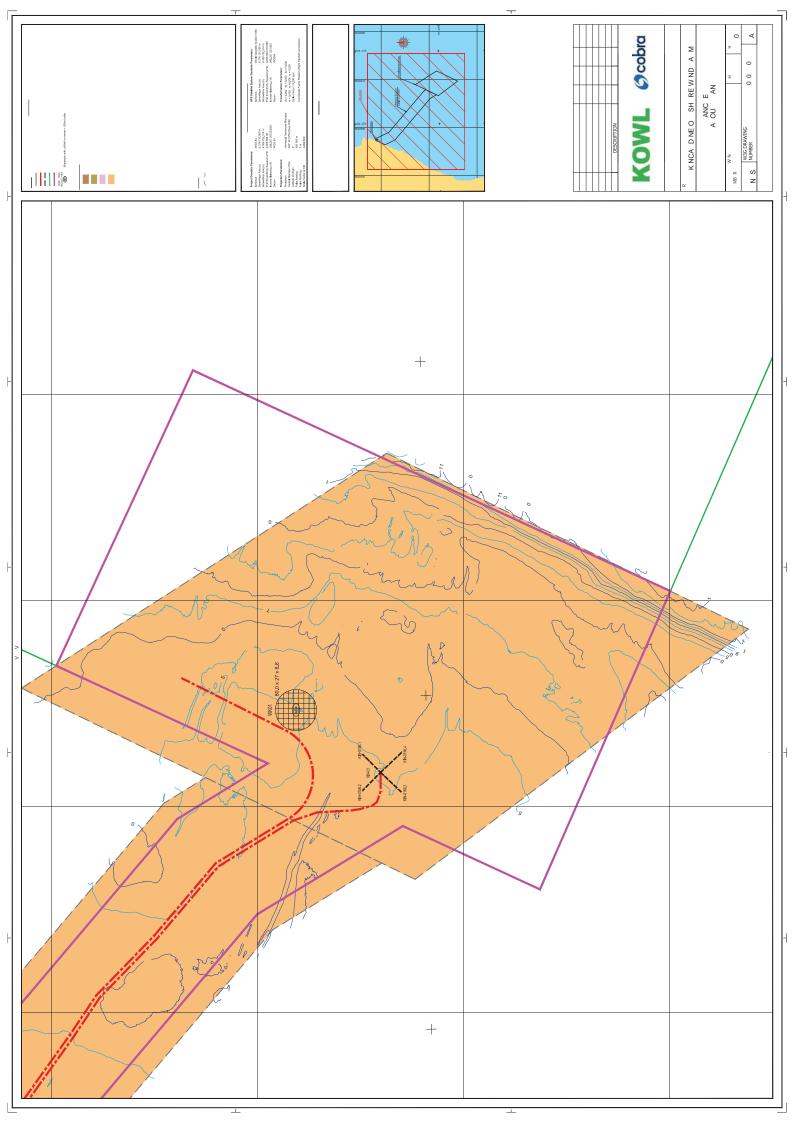
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**APPENDIX A TRANCHE 1 LAYOUT PLAN** 







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APPENDIX B FINAL LAYOUT PLAN

