Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Appendix 3.2: Offshore Project Parameters, Volume 1c

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Contents

List of Tables

1 INTRODUCTION

1.1.1.1 This appendix of the Environmental Impact Assessment Report (EIAR) provides a summary of the parameters that are detailed **Chapter 3: Project Description, Volume 1a** for the proposed Spiorad na Mara Offshore Wind Farm (hereafter referred to as the 'Offshore Project').

Table 1-1: Maximum Design parameters for Offshore Project Boundary

Parameter	**Measurement**
Array Area	161 km^2
Turbine Area	140 km^2
OCAS	47 km^2
Offshore Project Boundary (Array Area + OCAS)	208 km^2
Distance from shore to Array Area	5 - 13 km
Distance from shore to Turbine Area	6 - 13 km
Water depth range in Array Area/Turbine Area	37 to 67 / 72 m (MSL)

Table 1-2: Maximum Design Parameters for Boulder Clearance

Parameter		Maximum Design Parameter	
Structures (WTGs and OSP)			
Maximum boulder clearance WTGs and OSP foundation installation (includes foundations and installation Jack Up Vessels)		3,600,000 m^2	
Cables			
ID	**Parameter**	**Cable Scenario 1 (OSP)**	**Cable Scenario 2 (Onshore Landfall Substation)**
A	Maximum length Array Cables (to OSP)	160 km	N/A
B	Maximum length Export Cable	30 km	N/A
C	Maximum length Array Cables to Landfall	N/A	350 km
D	Maximum boulder clearance width	15 m	15 m
E	Maximum boulder clearance for Offshore Cables	2.76 km^2 [(A x D) + (B x D x 80%)]	5.25 km^2 [C x D]
F	Maximum corridor width of seabed disturbance (includes 15 m corridor plus 5m either side for spoil)	25 m	25 m
G	Maximum disturbed seabed Array Cables (to OSP)	4 km^2 [A x F]	N/A
H	Maximum disturbed seabed Export Cables	0.75 km^2 [B x F]	N/A
I	Maximum disturbed seabed Array Cables to Landfall	N/A	8.75 km^2 [C x F]

Table 1-3: Maximum Design Parameters for Wind Turbine Generator multi-leg jacket foundations with pin piles

Parameter	Maximum Design Parameter
Jacket leg spacing at MSL	15-35 m
Maximum number of legs per multi-leg foundation	Up to 4
Maximum number of multi-jacket legs	240
Maximum Leg diameter	5 m
Jacket leg spacing at seabed level	30-55 m
Maximum number of pin piles per multi-leg foundation	4
Maximum number of pin piles	240
Maximum Pin pile diameter	5 m
Embedment depth (below seabed) (turbine area outside of buried channel)	15-70 m
Embedment depth (below seabed) (turbine area inside buried channel)	15-120 m
Maximum seabed footprint per pile	30 m^2
Maximum total permanent seabed pile footprint	7,200 m^2

Table 1-4: Maximum Design Parameters for Offshore Substation Platform multi-leg jacket foundation with pin piles

Parameter	Maximum Design Parameter
Jacket leg spacing at MSL	10 - 40 m
Jacket leg spacing at seabed	30 - 60 m
Maximum number of legs per multi-leg foundation	8
Maximum number of pin piles per leg	2
Maximum leg diameter	6 m
Total number of pin piles for OSP	16
Pin pile diameter	6 m
Pile penetration depth (below seabed)	20 -120 m
Maximum dimensions of mud-mats (if required)	8 x 30 m
Seabed footprint per pile (including mud mats)	240 m^2
Total permanent seabed pile footprint (including mud mats)	1,920 m^2

Table 1-5: Maximum Design Parameters for Drill & Grout Wind Turbine Generator Pin Piles Installation

Parameter	Maximum Design Parameter
Drilling depth for drill & grout (turbine area outside of buried channel)	15 to 70 m
Maximum drill arising per pile per day (outside of buried channel)	1,374 m^3
Drilling depth for drill & grout (turbine area inside buried channel)	15-120 m
Maximum drill arising per pile per day (inside of channel)	2,356 m^3
No. piles per WTG	4
Assumed volume of drill arisings per pile (m3) (average 30m penetration depth)	588 m^3
Assumed maximum volume of drill Arisings for OWF	141,120 m^3
Maximum hammer energy (kJ) (if required for drill casing installation)	5,000 kJ

Table 1-6: Maximum Design Parameters for Drill & Grout Offshore Substation Platform Pin Piles Installation

Parameter	Maximum Design Parameter
Drilling depth for drill & grout (turbine area outside of buried channel)	15 to 60 m
Maximum No. piles per OSP	16
Assumed volume of drill arisings per pile (m^3) (maximum 60 m penetration depth)	1,000m^3
Assumed maximum volume of drill arisings for OSP	16,000 m^3
Maximum hammer energy (kJ) (if required for drill casing installation)	5,000 kJ

Table 1-7: Maximum Design Parameters for Percussive Pile Installation

Parameter	Maximum Design Parameter
Number of WTG and OSP foundations requiring percussive piling	Up to 36 (35 WTG + 1 OSP)
Total number of pin piles (WTG and OSP)	156
Maximum hammer energy	5,000 kJ
Initial hammer energy	550 kJ

Table 1-8: Maximum Design Parameters for Wind Turbine Generator multi-leg jacket foundations with Hybrid Gravity Base

Parameter	Maximum Design Parameter
Maximum Number of jacket legs per HGB foundation	4
Jacket leg spacing at MSL	15-35 m
Maximum size of top of HGB shaft	10 m x 10 m
Maximum height of shaft in water column	65 m
Maximum bottom of HGB shaft (foundation footprint)	55 x 55 m
Total seabed footprint of OWF foundations	181,500 m^2
Foundation height above seabed	5 m
Foundation penetration depth if no bedding material	0-5 m
Foundation bedding material	geotextile or mattress
Bedding depth	5 m
Volume of bedding material per WTG	15,000 m^3
Total Volume of bedding material for OWF	900,000 m^3
Height of platform above Lowest Astronomical Tide (LAT)	15-25 m

Table 1-9: Maximum Design Parameters for OSP multi-leg jacket foundations with Hybrid Gravity Base

Parameter	Maximum Design Parameter
Number of jacket legs per HGB foundation	8
Jacket leg spacing at MSL	15-35 m
Hybrid GBS footprint	5,000 m^2
Total seabed footprint for OSP	5,000 m^2
Foundation height above seabed	5 m
Maximum Foundation penetration depth if no bedding material	5 m
Maximum Foundation bedding material	geotextile or mattress
Maximum Bedding depth	5 m
Maximum volume of bedding material	15,000 m^3
Height of platform above LAT	15-25 m

Table 1-10: WTG and OSP foundations scour protection parameters

Parameter	Maximum Design Parameter
Scour protection type	Typical Inert Material (e.g. rock, concrete etc.)
Height of scour protection	3 m
Maximum scour protection footprint	105 m x 105 m
Scour protection area (excluding foundation) per WTG	8,000 m^2
Scour protection area (including foundation) per WTG	11,025 m^2
Scour protection area for OSP (excluding foundation)	1,500 m^2
Scour protection area for OSP (including foundation)	5,000 m^2
Area of foundation and scour protection (WTGs and OSP)	661,500 m^2
Volume of scour protection material per WTG	24,000 m^3
Volume of scour protection material for all WTGs	1,440,000 m^3
Volume of Scour protection material for OSP	4,500 m^3
Total volume of scour protection (WTGs and OSP)	1,444,500 m^3

Table 1-11: Maximum Design Parameters for Wind Turbine Generators

Assessment Parameter	Smaller WTG type	Larger WTG type
Maximum Number of WTGs	60	44
Maximum Rotor Diameter	236 m	280 m
Maximum Blade Tip Height (above Mean Sea Level (MSL))	293.8 m	338.4 m
Maximum interface level	50 m AMSL	50 m AMSL
Minimum Air Gap (between minimum blade tip height and MSL)	30 m	30 m
Maximum Chord	5.3 m	8 m
Maximum rotation per minute	9.3 rpm	10 rpm
Minimum turbine spacing	900 m	900 m
Maximum Swept Area of Rotor	2,624,612 m^2	2,709,310 m^2

Table 1-12: Maximum Design Parameters for WTG Oil and Fluid Consumption

Parameter	Exchange Intervals	Maximum per WTG
Grease (litres) per WTG	Up to 50 l / year	255 l
Hydraulic Oil (litres) per WTG	Every 10 years	1,100 l
Gear Oil (litres) per WTG	Every 10 years	2,700 l
Nitrogen (litres) per WTG	N/A	63,000 l
Water/Glycerol (litres) per WTG	N/A	1,400 l
Transformer Silicon/Ester oil (litres/kg) per WTG	N/A	12,000 l
Sulphur Hexafluoride 6 (SF6) (kg) per WTG	N/A	24

Table 1-13: Jack-up vessel parameters

Parameter	Maximum Design Parameter
Number of legs per vessel	4 legs
Area of spud cans	280 m^2
Leg penetration range	0-10 m
Number of jack-up positions per WTG	Up to 2
Number of jack-up positions per OSP	Up to 4

Table 1-14: Maximum parameters for Offshore Substation

Component	Parameter	Maximum Design Parameter
Topside	Number of OSPs	1
	Height of main structure and helideck above MSL	90 m
	Length & width of topside structure above MSL	70 m
	Height of lightning protection and ancillary structures	110 m
	Topside length and width	70 x 70 m
Consumables	Diesel fuel (litres)	160,000 ltr
	Transformer oil	900,000 kg
	SF6	6,000 kg
	Fire suppressant system	10,000 foam and 10,000 Argonite ltr
	HVAC cooling	5,000 ltr

Table 1-15: Offshore Cable Parameters

Assessment Parameter	Scenario 1 (OSP)	Scenario 2 (Landfall Substation)
Array Cables within the Array Area		
Maximum Cable voltage	132 kV	132 kV
Maximum Cable Diameter	300 mm	300 mm
Maximum Length of Cable	160 km	160 km
Maximum Trench Width (excluding jetting)	10 m	10 m
Maximum Trench Width (jetting)	7 m	7 m
Maximum Cable Burial Depth	2 m	2 m
Maximum Seabed Disturbance corridor width	25 m	25 m
Maximum Number of Circuits	12	12
Array Cables within the OCAS		
Maximum Cable voltage	N/A	132 kV
Maximum Cable Diameter	N/A	300 mm
Maximum Length of Cable	N/A	190 km
Maximum Number of Cable trenches	N/A	12
Maximum Trench Width (excluding jetting)	N/A	10 m
Maximum Trench Width (jetting)	N/A	7 m
Maximum Cable Burial Depth	N/A	2 m
Maximum Seabed Disturbance corridor width	N/A	25 m
Maximum Number of Circuits (HVAC)	N/A	12
Export Cable within the OCAS		
Maximum Cable voltage	275 kV	N/A
Maximum Cable Diameter (not including protection sleeve)	400 mm	N/A
Maximum Length of Cable	30 km	N/A
Maximum Number of Cable trenches	2	N/A
Maximum Trench Width (excluding jetting)	10 m	N/A
Maximum Trench Width (jetting)	7 m	N/A
Maximum Cable Burial Depth	2 m	N/A
Maximum Seabed Disturbance corridor width	25 m	N/A
Maximum Number of Circuits (HVAC)	2	N/A

Table 1-16: Offshore Cable Installation and External Cable Protection Parameters

Parameter	Maximum Design Parameter		
Buried Cable Installation			
Installation technique	Ploughing	Jet Trenching	Mechanical Cutting
Maximum corridor width	10 m	7 m	2 m
Maximum burial depth	2 m		
Minimum burial depth	0.2 m		
Surface Laid Cable Installation			
Maximum % all cables to be surface laid cable	100%		
Pre lay carpet material	containing rock or other inert material		
Maximum width of pre lay carpet	5 m		
Maximum height pre lay carpet	0.3 m		
Maximum volume of pre lay carpet	1,130,000m^3		
Cable Protection (includes material used to "pin" cables in place)	**Buried Cable Installation**	**Surface Laid Cable Installation**	
Type of protection material	Inert material placement or cable protection sleeve		
Cable protection sleeve material	Inert material such as polyurethane, steel, aluminium, hybrid materials		
Cable protection placement material	Rock berm, rock bags, concrete mattress or other inert material		
Maximum width of cable protection	3 m	3 m	
Maximum height of cable protection (including pre lay carpet	0.5	1.1 m	
Maximum percentage of cables requiring cable protection	10%	100%	
Maximum cable protection volume (excluding pre lay carpet)	25,688 m^3	2,600,000 m^3	
Maximum total volume of material on seabed (carpet and protection)	25,688 m^3	3,730,000 m^3	
Offshore Cable laying anchorage			
Anchorage system	6-point mooring system with 3 m^2 anchors		
Maximum number of anchor deployments	Deployed every 500 m of cable (700 total)		
Maximum anchor footprint	126,000 m^2		

Table 1-17: Offshore Cable Landfall Parameters and Assumptions

Parameter	Scenario 1 (OSP)	Scenario 2 (Landfall Substation)
Offshore Cable	**Export Cable**	**Array Cable to Landfall**
Maximum number of cables	2	12
Maximum number of bores	3	13
Maximum number of exit pits required	3	13
Exit pit dimensions	75 m length x 5 m width x 3.5 m depth	75 m length x 5 m width x 3.5 m depth
Maximum volume of sediment excavated per exit pit	1,312.5 m^3	1,312.5 m^3
Maximum total volume of sediment excavated from all exit pits	3,937.5 m^3	17,062.5 m^3
Maximum volume of bore	1,285 m^3 (per bore)	
Water usage	3,000 litres (per bore)	
Duct depth	0 m - 40 m	
Approximate duration of Landfall works	8 months	31 months
Approximate duration of drilling per duct	3 - 6 weeks	
Approximate duration of total drilling per scenario	9 - 18 weeks	39 - 78 weeks
Working hours	24 hour working, 7 days a week	

Table 1-18: Maximum Parameters for Vessel and helicopter movements during construction phase

Parameter	Maximum Installation Vessel Number on Site at any One Time	Maximum Installation Vessel Movements (Return Trips) (per year)
Main Installation and Support Vessels		
WTG installation vessel	1	12-15 trips
Jacket installation vessel	1	2 trips
Drilling vessels	2	4 trips
Grout vessel and Pile Supply vessel	2	60-80 trips
Barges	2	50-80 trips
Pile install vessel	1	20-60 trips
Cable Lay Installation & Support Vessels	9	100 trips
Other vessels		
Tug/Anchor Handlers	2	60-180 trips
Guard Vessels	2	12 to 25 trips

Parameter	Maximum Installation Vessel Number on Site at any One Time	Maximum Installation Vessel Movements (Return Trips) (per year)
Seabed preparation vessels for boulder removal, grapnel, pre-sweep/levelling	6	12-25 trips
Crew Transfer Vessels	3	250 trips
Scour Protection Installation Vessels	2	12-25 trips
Cable Protection Installation Vessels	2	12-25 trips
Helicopters	1	50 trips
Total (excluding helicopters)	35	871

Table 1-19: Project Design Envelope for Operation and Maintenance activities

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	Scenario 2 (Onshore Landfall Substation)
Foundations (WTGs)	Scheduled Inspections	Inspections of foundations, including Transition Piece and ancillary structures (e.g. J-tubes), above and below sea level.	Up to 35 main scheduled inspection and maintenance visits per turbine across the Offshore Project's lifetime. To include topside and subsea inspection.	
	Site investigation surveys	Survey of seabed and assets.	As dictated by seabed mobility risks and design of foundations. These can be undertaken every 1-3 years. There may be extra surveys to support jack-up deployment or cable health monitoring.	
	Repairs and replacements of navigational equipment	Repairs and replacements of electrical equipment such as lighting, fog horns, navigation lights and transponders.	As required up to 10 times per year per turbine.	
	Removal of marine growth	Removal of marine growth from foundations, transition pieces, or access ladders.	As required annually per turbine.	
	Replacement of corrosion protection anodes	Remove and replace anodes required for corrosion protection.	As required every 5 years.	
	Painting	Application of paint or other coatings to protect the foundations from corrosion (internal/external), including surface preparation.	As required annually per turbine.	

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	**Scenario 2 (Onshore Landfall Substation)**
	Replacement of access ladders and boat landings	Removal and replacement of ancillary structures (e.g. access ladders and boat landings).	As required throughout Offshore Project lifetime.	
	Modifications to/replacement of J-tubes	Modifications to/ replacement of J-tubes e.g. during Offshore Cable repair works.	As required throughout Offshore Project lifetime.	
WTGs	Scheduled inspections	Inspections within the WTG/on the exterior of the WTG, e.g. blade inspections.	Up to 35 main scheduled inspection and maintenance visits per turbine across the Offshore Project lifetime.	
	Replacement of consumables	Replacement of consumables within the WTG (e.g. filters, oils, lubricants).	Up to 35 replacements per turbine undertaken during main scheduled inspection and maintenance visits.	
	Minor repairs and replacements within the WTG	Minor repairs and replacements (like-for-like) within the turbine e.g. motors, pumps, small electric equipment, circuit breakers, fuses.	Up to 10 times per year per turbine.	
	Major component replacement	Replacement of blades, gearboxes, transformers or generators.	Up to 3 replacements per turbine across the Offshore Project lifetime.	
	Painting or other coatings	Paint or other coatings applied (internal/external). Coatings on the blades and minor paint repairs to tower and nacelle.	As required annually per turbine.	
Foundations (OSP)	Removal of marine growth	Removal of marine growth from foundations or access ladders.	N/A	As required annually for the OSP.
	Replacement of corrosion protection anodes	Remove and replace anodes required for corrosion protection.	N/A	As required every 5 years.
	Painting	Application of paint or other coatings to protect the foundations from corrosion (internal/external), including surface preparation.	N/A	As required annual for the OSP.

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	**Scenario 2 (Onshore Landfall Substation)**
	Replacement of access ladders and boat landings	Removal and replacement of ancillary structures (e.g. access ladders and boat landings).	N/A	As required throughout Offshore Project lifetime.
	Modifications to/replacement of J-tubes	Modifications to/ replacement of J-tubes e.g. during Array or Export Cable repair works.	N/A	As required throughout Offshore Project lifetime.
OSP	Scheduled inspections	Inspections within the OSP/on the exterior of the OSP.	N/A	Up to 70 main scheduled inspection and maintenance visits across the Offshore Project lifetime. Up to 350 smaller scheduled inspections visits across the Offshore Project lifetime.
	Replacement of consumables and minor components.	Replacement of consumables (e.g., oils, lubricants) and minor components within the OSP.	N/A	Up to 70 undertaken during main scheduled inspection and maintenance visits.
	Major component replacement	Replacement of transformers, switchgear etc.	N/A	Up to 3 times across Offshore Project lifetime.
	Painting or other coatings	Paint or other coatings applied (internal/external).	N/A	As required annually for the OSP.
Offshore Cables (Array and Export)	Routine inspections	Inspections of the cable and any cable protection, including at their entry into J-tubes on offshore structures.	Up to 1 scheduled inspection visit per year.	
	Site investigation surveys	Survey of sea bed and cable protection (if present).	Up to once per year.	
	Offshore Cable repair	Repair/protection replacement of Offshore	Up to 6 times across Offshore Project lifetime.	Up to 9 times across Offshore Project lifetime.

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	Scenario 2 (Onshore Landfall Substation)
		Cable section/whole Offshore Cable.		
	Offshore Cable remediation	Reburial of exposed Offshore Cable section.	Up to 6 times across Offshore Project lifetime.	

Table 1-20: Project Design Envelope for Vessel Activities Operation and Maintenance (O&M)

Aspect	Parameter	Maximum Design Envelope
Vessel numbers (maximum on site at any one time)	Crew Transfer Vessel / Workboats	3
	Jack-up Vessels	1
	Cable repair vessels	1
	Other vessels	4
	Excavators or backhoe dredger	1
	Helicopters	1
Total O&M Vessel Movements (Return Trips) (Total for lifetime of Offshore Project)	Crew Transfer Vessel / Workboats	31,850 movements
	Jack-up Vessels	140 movements
	Cable repair vessels	12 movements
	Other vessels	20 movements
	Excavators or backhoe dredger	12 movements
	Helicopters	70 movements
	Total (excluding helicopters)	32,034 movements
Fuel consumption during the O&M phase		CTVs typically use 500-800 litres per day SOVs typically use between 5,000-8,000 litres per day