FIVE ESTUARIES OFFSHORE WIND FARM

ENVIRONMENTAL STATEMENT

VOLUME 6, PART 2, ANNEX 1.1: DETAILED OFFSHORE PROJECT DESIGN ENVELOPE

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TABLES

DEFINITION OF ACRONYMS

Term	Definition
ECC	Export Cable Corridor
GBS	Gravity Based Structure
JUV	Jack-Up Vessel
MDS	Maximum Design Scenario
O&M	Operations And Maintenance
OSP	Offshore Substation Platform
PVMs	Permanent Vessel Moorings
TJB	Transition Joint Bay
UXO	Unexploded Ordnance
VE	Five Estuaries Offshore Wind farm
WTG	Wind Turbine Generator

1 OFFSHORE MDS PARAMETERS

1.1.1 This document outlines the Maximum Design Parameters (MDS) for the offshore elements of the Five Estuaries Offshore Wind Farm. This document should be read in conjunction with Volume 6, Part 2, Chapter 1: Offshore Project Description.

1.1.2 Please refer to the table of contents above and/ or the cross references below to navigate to each table.

1.1.3 List of MDS Tables:

Table 1.1: Maximum design parameters for WTG design envelope

Parameter	Monopile foundation		Suction bucket monopile foundation		Gravity base monopile foundation		Pin-piled jacket foundation		Suction bucket jacket foundation		Gravity base jacket foundation	
	Small	Large	Small	Large	Small	Large	Small	Large	Small	Small	Small	Large
Maximum foundation number	79	41	79	41	79	41	79	41	79	41	79	41
Seabed preparation												
Seabed preparation area per foundation (m^2)	< Other options (also depends on cable and vessel requirements)	-	< Other options (indicatively 1,257)	-	2,827	-	< Other options (also depends on cable and vessel requirements)	-	1,963	-	3,600	-
Seabed preparation area for all foundations (m^2)	< Other options (also depends on cable and vessel requirements)	-	< Other options (indicatively 99,274)	-	223,367	-	< Other options (also depends on cable and vessel requirements)	-	155,116	-	284,400	-
Indicative average Seabed preparation depth (m)		-	4	-	4	-	-	-	4	-	4	-
Seabed preparation spoil volume per foundation(m^3)	< Other options (also depends on cable and vessel requirements)	-	< Other options (indicatively 5,027)	-	11,308	-	< Other options (also depends on cable and vessel requirements)	-	7,854	-	14,400	-
Seabed preparation spoil volume for all foundations(m^3)	< Other options (also depends on cable and vessel requirements)	-	397,097	-	893,467	-	< Other options (also depends on cable and vessel requirements)	-	620,464	-	1,137,600	-
Scour protection												
Scour protection area per foundation	5,234	-	7,904	-	14,251	-	1,482	-	9,312	-	14,251	-

Parameter	Monopile foundation		Suction bucket monopile foundation		Gravity base monopile foundation		Pin-piled jacket foundation		Suction bucket jacket foundation		Gravity base jacket foundation	
	Small	Large	Small	Large	Small	Large	Small	Large	Small	Small	Small	Large
(m^2) (exc structure footprint)												
Scour protection volume per foundation (m^3)	9,450	-	14,476	-	26,699	-	1,959	-	15,808	-	26,699	-
Scour protection volume for all foundations (m^3)	746,542	-	1,143,638	-	2,109,235	-	154,744	-	1,248,869	-	2,109,235	-
Footprints												
Total structure footprint per foundation (excluding scour protection) (m^2)	177	-	1,257	-	2,827	-	39	-	1,963	-	3,600	-
Total structure footprint for all foundations (excluding scour protection) (m^2)	13,960	-	99,274	-	223,367	-	3,040	-	155,116	-	284,400	-
Total structure footprint per foundation (including scour protection) (m^2)	5,411	-	9,161	-	16,627	-	1,521	-	10,568	-	16,627	-
Total structure footprint for all foundations (including scour protection) (m^2)	427,437	-	723,709	-	1,313,537	-	120,122	-	834,896	-	1,313,537	-
Hammer energy												
Maximum hammer energy (kJ)	7,000	-	-	-	-	-	3,000	-	-	-	-	-

Parameter	Monopile foundation		Suction bucket monopile foundation		Gravity base monopile foundation		Pin-piled jacket foundation		Suction bucket jacket foundation		Gravity base jacket foundation	
	Small	Large	Small	Large	Small	Large	Small	Large	Small	Small	Small	Large
Drilling												
Foundations requiring drilling (%)	50	-	-	-	-	-	100	-	-	-	-	-
Drill diameter (m)	16	-	-	-	-	-	3.5	-	-	-	-	-
Typical drill penetration depth (m)	68	-	-	-	-	-	60	-	-	-	-	-
Drilling spoil volume per foundation (m^3)	14,000	-	-	-	-	-	2,308	-	-	-	-	-
Drilling spoil volume for all foundations (m^3)	536,080	-	-	-	-	-	182,416	-	-	-	-	-

Table 1.2: Maximum design parameters for OSP design envelope

Parameter	Monopile foundation	Gravity base foundation (monopile or jacket)		Pin-piled jacket foundation		Suction bucket jacket foundation	
	1 OSP	1 OSP	2 OSP	1 OSP	2 OSP	1 OSP	2 OSP
Seabed preparation							
Seabed preparation area (m^2)	< Other options (also depends on cable and vessel requirements)	7,000	14,000	< Other options (also depends on cable and vessel requirements)	< Other options (also depends on cable and vessel requirements)	4,241	8,482
Seabed preparation spoil volume (m^3)	< Other options (also depends on cable and vessel requirements)	28,000	56,000	< Other options (also depends on cable and vessel requirements)	< Other options (also depends on cable and vessel requirements)	16,964	33,929
Scour protection							
Scour protection area (m^2) (exc structure footprint)	7,366	38,452	76,904	10,800	21,600	34,608	69,216
Scour protection volume per foundation (m^3)	13,526	74,065	148,129	21,600	43,200	62,731	125,463
Footprints							
Total structure footprint per foundation (excluding scour protection) (m^2)	177	7,000	14,000	120	240	1,885	3,770
Total structure footprint for all foundations (including scour protection) (m^2)	7,543	40,828	81,656	10,920	21,840	36,493	72,985
Maximum hammer energy (kJ)	7000	-	-	3000	-	-	-
Foundations requiring drilling (%)	100	-	-	100	100	-	-
Drill diameter (m)	16	-	-	3.5	3.5	-	-
Typical drill penetration depth (m)	68	-	-	60	-	-	-
Drilling spoil volume (m^3)	13,572	-	-	6,924	13,854	-	-

Table 1.3 MDS for boulder clearance

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Length of cable route requiring boulder clearance	25%	25%	N/A
Length of cable route requiring boulder clearance (km)	48.875	50	98.875
Width of boulder plough/ clearance tool (m)	18	18	N/A
Total area of seabed disturbed by boulder plough/ clearance (m^2)	879,750	900,000	1,779,750
Total area of seabed disturbed by boulder clearance (km^2)	0.88	0.90	1.78
Additional isolated boulders in remainder of route which may need cleared with grab type tool	100	200	300

Table 1.4 MDS for the use of a Pre-Lay Grapnel Run

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Length of cable route requiring PLGR	100%	100%	N/A
Length of cable route requiring PLGR (km)	196	200	396
Width of PLGR clearance corridor(m)	30	30	N/A
Total area of seabed disturbed by PLGR (m^2)	5,865,000	6,000,000	11,865,000
Total area of seabed disturbed by PLGR (km^2)	5.87	6	11.87

Table 1.5 MDS for UXO clearance

Parameter	Design Envelope
Expected total number of potential UXO targets	2,000
Expected number of UXO requiring clearance in the pre-construction phase	60
Maximum number of clearance events within 24 hours	2

Table 1.6 MDS for trial trenching

Parameter	Design Envelope		
	Export cables	Inter-array cables	Total
Total length of trial trenching (km)	5	5	10
Maximum burial depth (m)	3.5	3.5	N/A
Maximum installation tool seabed disturbance width (jetting) (m)	18	18	N/A
Total area of seabed disturbed by cable installation (m^2)	90,000	90,000	180,000
Total area of seabed disturbed by cable installation (km^2)	0.09	0.09	0.18
Total volume of sediment disturbed by cable installation[1] (m^3)	78,750	78,750	157,500

[1]Assuming a V-shaped trench in which 50% of sediment is fluidised and the remaining 50% re-suspended in the water column

Table 1.7 MDS for sandwave clearance / bed preparation

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Length of cable route requiring sandwave clearance	50%	75%	N/A
Length of cable route requiring sandwave clearance (km)	98	150	248
Total area of seabed disturbed by sandwave clearance (m^2)	5,054,000	10,690,059	15,744,059
Total area of seabed disturbed by sandwave clearance (km^2)	5.05	10.69	15.74
Total volume of sediment disturbed by sandwave clearance (m^3)	6,968,922	22,795,580	29,764,502
Maximum volume of material cleared from sandwaves requiring disposal (m^3)	6,968,922	22,795,580	29,764,502

Table 1.8 MDS for seabed preparation

Parameter	WTG foundations	OSP foundations	Total
Foundation type	79 x gravity base jacket foundations	2 x gravity base monopile foundation	N/A
Volume of gravel bed (m^3)	284,400	14,000	298,400

Table 1.9 Minimum spacing for structures in the northern and southern arrays

Structure	Minimu(m)
WTGs	830
OSP to nearest WTG	500

Table 1.10 Design envelope for WTGs

Parameter	Design Envelope	
	Small WTG	Large WTG
Number of WTGs	79	41
Minimum blade tip height above MHWS (m)	28	28
Maximum blade tip height above MHWS (m)	320	420
Maximum blade tip height above LAT (m)	324	424
Rotor diameter (m)	260	360
Largest rotor turbines combined weight		1,150

Table 1.11 Design envelope for oils and fluids for WTGs

Parameter	Design Envelope	
	Per Small WTG	Per Large WTG
Grease (l)	898	1,736
Hydraulic oil (l)	1,696	3,278
Gear oil (l)	3,330	6,437
Nitrogen (l)	108,728	210,207
Transformer silicon/ ester oil (l/ kg)	20,000	20,000
Diesel fuel (l)	1,000	1,000
Sulphur hexafluoride (SF6) kg)	180	180
Glycol/ coolant (l)	23,541	45,513
Batteries (kg)	2,700	4,100

Table 1.12 Design envelope for OSPs

Parameter	Design Envelope
Number of OSPs	2
Topside dimensions (m)	125 x 100
Topside height above LAT (excluding stowed crane, helideck and mast) (m)	105
Topside height above LAT (including stowed crane, helideck and mast)	195
Maximum unstowed crane height above LAT (m)	195
Maximum HVAC system voltage (primary) (kV)	275
Maximum HVAC system voltage (secondary) (kV)	132

Table 1.13 Design envelope for oils and fluids per OSP

Parameter	Design Envelope
Grease (l)	Minimal
Hydraulic oil (l)	3,000
Gear oil (l)	1,000
Nitrogen (l)	Minimal
Transformer silicon/ ester oil (l/kg)	340,000
Diesel fuel (l)	120,000
Sulphur hexafluoride (SF6) kg)	10,000
Glycol/ coolant (l)	90,000
Batteries (kg)	350,000
Grey water (l)	5,000
Black water (l)	3,000

Table 1.14 Design envelope for monopiles

Parameter	Design Envelope		
	Large WTG	Small WTG	OSP
Number of monopiles	41	79	2
Diameter (m)	15	13	15
Typical embedment depth (m)	68	68	68

Table 1.15 Design envelope for multi-leg pin-piled jackets

Parameter	Design Envelope		
	Large WTG	Small WTG	OSP
Number of jacket foundations	41	79	2
Number of legs per foundation	4	4	6
Pin-piles per leg	1	1	2
Total pin-piles	164	316	24
Pin-pile diameter (m)[2]	3.5	3.5	3.5
Typical pin-pile embedment depth (m)	60	60	60
Maximum separation of adjacent legs at seabed level (m)	45	45	60 x 100
Maximum separation of adjacent legs at sea level (LAT) (m)	35	35	50 x 90

[2] For WTG Foundations 4 legged jackets with a maximum pin pile diameter of 3.5m are selected as the MDS for the project description. The final project design may elect to use 3 legged jackets for WTG Foundations, and in such a case a pin pile diameter of 4m is foreseen as possible (and within the MDS assessed).

Table 1.16 Piling scenarios

Parameter	Soft Start		Ramp up				Max
Monopile							
Hammer energy (kJ)	1,050	1050	1,400	2,800	4,200	5,600	7,000
Strikes	100	100	200	200	200	200	15,563
Duration (s)	600	300	300	300	300	300	24,900
Blow rate (blows per minute)	10 bl/min	Burst*	40 bl/min				37.5 bl/min
* The "burst" stage represents 30 s piling at 40 bl/min followed by a 30 s pause in piling, repeated for 5 minutes. 1 pile: 16,563 strikes, 7 hours 30 minutes duration							
Pin Pile							
Hammer energy (kJ)	450	450	600	1,200	1,800	2,400	3,000
Strikes	100	100	200	200	200	200	7,688
Duration (s)	600	300	300	300	300	300	12,300
Strike rate (strikes per minute)	10	Burst*	40 bl/min				~ 37.5 bl/min
* The "burst" stage represents 30 s piling at 40 bl/min followed by a 30 s pause in piling, repeated for 5 minutes. 1 pile: 8,688 strikes, 4 hours 00 minutes duration 4 piles: 34,752 strikes, 16 hours 00 minutes duration							

Table 1.17 Design envelope for mono suction caisson foundations

Parameter	Design Envelope	
	Large WTG	Small WTG
Number of foundations	41	79
Suction caisson diameter (m)	40	40
Monopile diameter at sea surface (MSL) (m)	15	13
Typical suction caisson penetration depth (m)	25	25
Height of suction caisson above seabed level (m)	8	8

Table 1.18 Design envelope for multi-leg suction caisson jacket foundations

Parameter	Design Envelope	
	Large WTG	Small WTG
Number of foundations	41	79
Number of buckets per foundation	4	4
Suction caisson diameter per leg (m)	20	20
Typical suction caisson penetration depth (m)	25	25
Indicative Height of suction caisson above seabed level (m)	5	5
Separation of adjacent legs at seabed level (m)	40	40
Separation of adjacent legs at sea level (LAT) (m)	30	30

Table 1.19 Design envelope for mono GBS foundations

Parameter	Design Envelope		
	Large WTG	Small WTG	OSP
Number of jacket foundations	41	79	2
GBS base diameter (m)	55	55	55
Shaft diameter at sea surface (MSL) (m)	15	15	15
Maximum height of base above the seabed (m) (will taper down above this height)	8	8	8
Gravel bed requirements			
Area of gravel bed (m^2) per foundation	2,827	2,827	7,000
Thickness of gravel bed (m)	1	1	1
Volume of gravel bed per foundation (m^3)	2,827	2,827	7,000
Total area of gravel bed required (m^2)	115,907	223,333	14,000
Total volume of gravel bed required (m^3)	115,907	223,333	14,000
Surface area			
Surface area of water facing structure per foundation (m^2)	5,450	5,450	6,700
Total surface area of water facing structure (m^2)	223,450	430,550	13,400

Table 1.20 Design envelope for multi-leg GBS foundations

Parameter	Design Envelope	
	Large WTG	Small WTG
Number of jacket foundations	41	79
Separation of adjacent legs at seabed level (m)	45	45
Separation of adjacent legs at sea level (LAT) (m)	35	35
Number of bases per foundation	4	4
GBS diameter (m) (if separate bases per leg) – as an alternative a 50x50m single square base is also considered	20	20
Height of GBS above seabed level (m)	8	8
Gravel bed requirements		
Area of gravel bed (m^2) per foundation (the maximum area assumes a single base rather than up to four separate bases per WTG)	3,600	3,600
Thickness of gravel bed (m)	1	1
Volume of gravel bed per foundation (m^3) (the maximum area assumes a single base rather than up to four separate bases per WTG)	3,600	3,600
Total area of gravel bed required (m^2)	147,600	284,400
Total volume of gravel bed required (m^3)	147,600	284,400

Table 1.21 MDS for array cables

Parameter	Design Envelope
Cable parameters	
Maximum system voltage (kV)	132
External cable diameter (mm)	250
Total length of array cables (km)	200
Cable installation	
Maximum burial depth (m)	3.5
Minimum burial depth (m)	0 (see cable protection requirements in Section 1.10 in Volume 6, Part 2, Chapter 1: Offshore Project Description)
Maximum installation tool seabed disturbance width (jetting) (m)	18
Total area of seabed disturbed by cable installation (m^2)	3,600,000
Total area of seabed disturbed by cable installation (km^2)	3.6
Total volume of sediment disturbed by cable installation[3] (m^3)	3,150,000
Total volume of sediment disturbed by cable installation[3] (km^3)	0.00315

[3] Assuming a V-shaped trench in which 50% of sediment is fluidised and the remaining 50% re-suspended in the water column

Table 1.22 MDS for offshore export cables

Parameter	Design Envelope
Cable parameters	
Maximum system voltage (kV)	275
Indicative external cable diameter (mm)	310
Number of export cable circuits	2
Total length of export cables (km)	196
Cable installation	
Indicative maximum burial depth (m) [4]	3.5
Minimum burial depth (m)	0 (see cable protection requirements in Section 1.7 of Volume 6, Part 2,Chapter 1: Offshore Project Description)
Maximum installation tool seabed disturbance width (jetting) (m)	18
Total area of seabed disturbed by cable installation (m^2)	3,520,000
Total area of seabed disturbed by cable installation (km^2)	3.52
Total volume of sediment disturbed by cable installation[3] (m^3)	3,079,125
Total volume of sediment disturbed by cable installation[3] (km^3)	0.00308

[4] The maximum cable burial depth will be dependent on numerous factors and will vary along the offshore ECC. The cables will be buried below the seabed wherever possible, with a target burial depth defined post-consent in a Cable Burial Risk Assessment (CBRA) taking account of the ground conditions and other factors.

Table 1.23 MDS for dredged material disposal

Parameter	Disposal site 1	Disposal site 2	Disposal site 3	Total
Project location	Northern array	Southern array	Offshore ECC	N/A
Drill arisings (m^3)	283,715	283,715	N/A	567,430
Seabed preparation spoil volume for all foundations (m^3)	596,800	596,800	N/A	1,193,600
Maximum volume of material cleared from sandwaves requiring disposal (m^3)	11,397,790	11,397,790	6,968,922	29,764,502
Total (m^3)	12,278,305	12,278,305	6,968,922	31,525,532
Total (km^3)	0.012278305	0.012278305	0.006968922	0.031525532

Table 1.24 MDS for cable protection

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Length of cable requiring cable protection (excluding cable ends protection) (%)	10	20	N/A
Length of cable requiring cable protection (minus cable crossings but including cable ends protection) (km)	18.5	54	72.2
Width of cable protection on seabed (m)	9.7	6	N/A
Height of cable protection berm (m)	1.1	1	N/A
Total area of seabed covered by cable protection (m^2)	178,304	321,600	499,904
Total volume of cable protection (m^3)	129,691	187,600	317,291

Table 1.25 Maximum design envelope for cable crossings

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Total number of crossings required	30	26	56
Length of crossings (m)	300	300	N/A
Total length of cable crossings (m)	9,000	7,800	16,800
Width of crossing (m)	13	13	N/A
Height of rock berm (m)	1.4	1.4	N/A
Cross sectional area of trapezoid (m^2)	12.2	12.2	N/A
Total area of seabed covered by cable crossings (m^2)[5]	119,300	103,400	222,700
Total volume of cable protection required (m^3)	111,400	96,500	207,900

Table 1.26 MDS for trenchless techniques

Parameter	Design Envelope
Number of cable circuits	2
Number of cable ducts/ HDD bores	3 (one per circuit plus one contingency)
Minimum HDD spacing (offshore) (m)	50 (100-200 m is anticipated)
Maximum HDD depth below the surface (m)	20
Indicative Subtidal HDD length (m)	1,100
Indicative Intertidal HDD length (m)	570

[5] These areas include for the concrete mattress typically laid along the exisitng cable. They are therefore slightly higher than the product of the total length and width of rock berm. The same comment applies to the volume row below.

Table 1.27 MDS for release of drilling mud

Parameter	Design Envelope
Maximum number of bores	3
Realistic case drilling mud volume based on forward ream (from the beach to offshore) per bore (m^3)	677
Realistic case drill cuttings based on forward ream (from the beach to offshore) per bore (m^3)	50
Worst case drilling mud volume based on back ream (from offshore towards the beach) per bore (m^3)	4,940
Worst case drill cuttings volume based on back ream (from offshore towards the beach) pre bore (m^3)	900
Total volume of drilling mud which could be released (m^3)	14,820
Total volume of drill cuttings which could be released (m3)	2,700
Maximum drilling mud volume to be released per tidal cycle (m3)	500

Table 1.28 MDS for exit pits

Parameter	Design Envelope
Number of exit pits	3
Width of each exit pit (m)	10
Length of each exit pit (m)	75
Area of each exit pit (m^2)	750
Total area of all exit pits (m^2)	2,250
Depth of each exit pit (m)	2.5
Volume excavated per exit pit (m^3)	1,875
Total volume excavated from exit pits (m^3)	5,625

Table 1.29 Design envelope for sheet piled exit pits associated with trenchless techniques

Parameter	Design Envelope
Number of sheet piled exit pits required	3

Table 1.30 Design envelope for the TJB compound

Parameter	Design Envelope
Number of export cable circuits	2
Number of TJBs	2
TJB dimensions (m)	20 x 5
Land take for TJBs compound during construction (m)	150 x 75
Permanent land take for all of TJBs during O&M (m^2)[6]	Upto 1200m^2

Table 1.31 MDS for O&M activities

Parameter	Design Envelope
O&M strategy	
Project lifetime (years)	Approximately 40
Surface infrastructure (WTGs and OSPs)	
Number of WTG and OSP major component replacements requiring JUVs over project lifetime	284
Allowance for foundation scour protection replenishment	20% (451,480m^3)
Array cables	
Number of array cable repairs/ replacements over project lifetime	8
Seabed disturbance per array cable repair/replacement event (including vessel anchors) (m^2)	34,582

[6] This is the total area. It should be noted that TJBs may be spaced apart i.e. this area may consist of several smaller areas

Parameter	Design Envelope
Total seabed disturbance for array cables over project lifetime (m^2)	276,656
Total length of array cables requiring remedial burial over project lifetime via jetting,rock placement or similar techniques (m)	10,000
Seabed disturbance volume per array cable repair/replacement event (including vessel anchors) (m^3)	53,762
Total seabed disturbance volume for array cables over project lifetime (m^3)	430,096
Offshore export cables	
Number of offshore export cable repairs over project lifetime	9
Seabed disturbance per export cable repair event (including vessel anchors) (m^2)	16,205
Total seabed disturbance for offshore export cables over project lifetime (m^2)	145,842
Total length of export cables requiring remedial burial over project lifetime via jetting, rock placement or similar techniques (m)	5,000
Seabed disturbance volume per offshore export cable repair event (including vessel anchors) (m3)	25,057
Total seabed disturbance volume for offshore export cables over project lifetime (m3)	225,513

Table 1.32 Peak construction vessels and round trips to site

Vessel type	Peak vessels	Round Trips
Foundations		
WTG and OSP foundation installation vessels (includes tugs and feeders)	38	1359
WTGs and OSPs		
WTG installation vessels (includes tugs and feeders)	10	71
OSP topside installation vessels (includes tugs and feeders)	4	8
Other installation vessels		
Commissioning (including accommodation vessels)	5	130
Other vessels	15	2,300
Cable installation vessels (incl. seabed preparation vessels)		
Array cable installation vessels (includes support, cable protection and anchor handling vessels)	12	166
Export cable installation spreads (includes support, cable protection and anchor handling vessels)	12	278
Total construction vessels		
Maximum total construction vessels	96	4,311
Indicative peak vessels on-site simultaneously	35	N/A

Table 1.33 MDS for JUV operations during the construction phase

Parameter	Design Envelope
Maximum JUV operations during construction	504
Individual spud can footprint (m^2)	275
Maximum seabed area per JUV operation (m^2)	1,100
Maximum seabed area impacted for all JUV operations (m^2)	554,400
Typical seabed penetration (m)	15
Maximum volume of sediment disturbed per JUV operation (m^3)	16,500
Maximum volume of sediment disturbed for all JUV operations (m^3)	8,316,000

Table 1.34 MDS for anchor footprints for WTG and OSP installation (foundations and topsides) during the construction phase

Parameter	Design Envelope
Number of locations	81 (79 WTGS + 2 OSPs)
Number of anchors per deployment	8
Number of deployments per location	5 (4 per foundation, 1 per topside)
Anchor footprint (deployment and recovery per anchor) (m^2)	117
Total anchor footprint per location (m^2)	936
Total impact area for WTG and OSP installation in the array (m^2)	379,080
Typical anchor penetration depth (m)	4
Total impact volume for WTG and OSP installation in the array (m^2)	1,516,320

Table 1.35 Design envelope for anchor footprints for the inter-array cables during the construction phase

Parameter	Design Envelope
Number of vessel moves	455
Number of anchors per deployment	9
Anchor footprint (deployment and recovery per anchor) (m^2)	61
Total anchor footprint per deployment	549
Total impact area for all anchors for inter-array cables (m^2)	249,795
Typical anchor penetration depth (m)	1.5
Total impact volume for all anchors for inter-array (m^2)	374,693

Table 1.36 Design envelope for anchor footprints in the offshore ECC during the construction phase

Parameter	Design Envelope
Number of vessel moves	444
Number of anchors per deployment	9
Anchor footprint (deployment and recovery per anchor) (m^2)	61
Total anchor footprint per deployment	549
Total impact area for all anchors in the offshore ECC (m^2)	242,604
Typical anchor penetration depth (m)	1.5
Total impact volume for all anchors in the offshore ECC (m^3)	363,906

Table 1.37 MDS O&M vessel requirements

Vessels	Design Envelope Peak vessels	Annual Round trips
Vessel description		
JUVs	3	9
SOVs	2	52
CTVs	9	1,642
Lift vessels	3	8
Cable maintenance	2	1
Auxiliary vessels	8	64
Total O&M vessels		
Total O&M vessels	27	1,776
Indicative peak vessels on-site simultaneously	27	N/A

Table 1.38 MDS for JUV requirements during O&M

Parameter	Design Envelope
Number of major component replacements requiring JUVs over project lifetime	284
Number of JUV operations per replacement	1
Individual spud can footprint (m^2)	275
Maximum seabed area per JUV operation (m^2)	1,100
Maximum seabed area impacted for all JUV operations (m^2)	312,400
Typical seabed penetration (m)	15
Maximum volume of sediment disturbed per JUV operation (m^3)	16,500
Maximum volume of sediment disturbed for all JUV operations (m^3)	4,686,000

Table 1.39 MDS for PVMs

Parameter	Design Envelope
Number of PVMs	6
Buoy diameter (m)	6
Maximum number of anchors per mooring	6
Maximum anchor width (m)	7
Anchor installation drag length (m)	80
Anchor penetration depth (m)	6
Total area of seabed disturbed by anchor installation (m^2)	20,160
Total volume of seabed disturbed by anchor installation (m^3)	120,960
Maximum impact footprint of all buoy chains on sea floor during operation (m^2)	698,520

FIVE ESTUARIES
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