Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Annex D to Appendix 8 of Deadline 8 Submission – Offshore Project Description Assessed in the Environmental Statement

Relevant Examination Deadline: 8

Submitted by Vattenfall Wind Power Ltd

Date: June 2019

Revision D

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Date of Approval:	June 2019
Revision:	D

Revision A	Original Document submitted to the Examining Authority
Revision B	Revised document submitted to the Examining Authority following consultation
Revision C	Revised document submitted to the Examining Authority following consultation
Revision D	Revised document submitted to the Examining Authority following consultation
Revision D	Unamended document submitted to the Examining Authority to Deadline 6
Revision D	Unamended document submitted to the Examining Authority to Deadline 7
Revision D	Unamended document submitted to the Examining Authority to Deadline 8

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1 Maximum Design Parameters

1 Volume 2, Chapter 1: Project Description (Offshore) (PINS Ref APP-042/ Application Ref 6.2.1) presented the proposed design envelope for the Thanet Extension Offshore Wind Farm (Thanet Extension). This clarification note should read in conjunction with PINS Ref APP-042/ Application Ref 6.2.1; and seeks to provide the maximum design envelope for the proposed Thanet Extension.

2 This document should be read in conjunction with the "Project Description Transcription into the Environmental Statement" clarification note (PINS Ref REP-003), in particular for the areas highlighted in the footnotes of this document.

3 Table 1 presents the maximum design parameters presented within the chapter and have been assessed by the Applicant within the Environmental Statement (ES). Table 1 also provides any assumptions applied within the ES such as design parameters of met mast foundations.

4 Table 1 presents design parameters from landfall Options 1 and 3 only following the removal of Option 2 from the project design envelope.

5 For ease of reference the calculated maximum total values assessed within the ES of their constituent parameters are presented in Table 2 to Table 14.

Table 1: Maximum design parameters assessed within the Thanet Extension Environmental Statement

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.1	Development located in the North Sea approximately	8km
Paragraph 1.3.2	Electrical output capacity	Up to 340 MW
Paragraph 1.1.1	Wind Turbine Generators (WTGs)	Up to 34 Wind Turbine Generators
Paragraph 1.1.1	Meteorological mast (met mast) fixed to the seabed	up to one Meteorological Mast
Paragraph 1.1.1	Floating Lidar Device (FLD) and wave buoys fixed to the seabed	Up to one LIDAR device and up to one wave buoy
Paragraph 1.1.1	Offshore substation fixed to the seabed	Up to one Offshore Substation
Paragraph 1.1.1	Offshore subsea export cables and fibre optic cables	Up to four offshore export cables

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.1	Total offshore site area (Order Limits) (km^2)	68.8
N/A	Total array area (Order Limits – Structure Exclusion Zone)	59.5
N/A	Total area of Structure Exclusion Zone (km^2)	9.3
Table 1.1	Total export cable site area (Order Limits) (km^2)	32.2
N/A	Total Cable Exclusion Area (CEA) area (km^2)	1.6
N/A	Total OECC area (km^2) (Order Limits – CEA)	30.6
Table 1.1	Maximum WTG Size	12 MW+
Paragraph 1.4.15	Minimum WTG spacing	716 m x 480 m[i]
Provided in PINS Ref REP4-019[ii].	Disposal	The disposal of inert material of natural origin.
Maximum design envelope for WTGs		
Table 1.2	Minimum height of lowest blade tip above MHWS (m)	22
Table 1.2	Maximum blade tip height above HAT (m)	250
Table 1.2	Maximum rotor blade diameter (m)	220
Provided in PINS Ref APP-053/ Application Ref 6.2.12	Maximum hub height above HAT (m)	140
Indicative maximum requirements for these oils and fluids for a single WTG		
Table 1.3	Grease (l)	2000
Table 1.3	Synthetic oil/ hydraulic oil (l)	2000
Table 1.3	Nitrogen (l)	200
Table 1.3	Transformer silicone oil (kg)	2000
Table 1.3	Sulphur hexafluoride (SF6) (kg)	100
Table 1.3	Water/ glycerol (l)	2000
Maximum design envelope for WTG monopile foundations		
Table 1.4	Diameter of monopile (top) (m)	7.5

[i] See the project description transcription clarification note (PINS Ref REP3-003) for how this has been assessed within the application.

[ii] Which supersedes PINS Ref APP-148/ Application Ref 8.14.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.4	Diameter of monopile (bottom) (m)	10
Table 1.4	Diameter of transition piece (top diameter at TP-tower interface) (m)	7.5
Table 1.4	Diameter of transition piece (bottom diameter at MP-TP interface) (m)	10
Table 1.4	Embedment depth (below seabed) (m)	75
Table 1.4	Drill diameter (m)	7.5
Table 1.4	Volume of drill arisings per pile (m^3)	1,325
Table 1.4	Locations requiring drilling (%)	50
Table 1.4	Locations potentially installed by driven piling (%)	100
Table 1.4	Total drill arisings for WTG monopiles (m^3)	19,627[iii]
Table 1.4	Grout volume per foundation (m^3)	120
Table 1.4	Hammer energy (kJ)	5,000
Table 1.4	Number of blows per foundation	8,000
Table 1.4	Piling time per foundation (assuming issues such as low blow rate, refusal etc.) (hours)	6
Maximum design envelope for WTG quadropod jacket foundations		
Table 1.5	Number of legs per foundation	4
Table 1.5	Separation of adjacent legs at seabed level (m)	40
Table 1.5	Separation of adjacent legs at Mean Sea Level (MSL) (m)	20
Table 1.5	Height of main access platform above HAT (m)	20
Table 1.5	Leg diameter (m)	3.5
Table 1.5	Embedment depth (below seabed) (m)	70
Table 1.5	Volume of drill arisings per foundation (four pin-piles) (m^3)	1,400
Table 1.5	Locations requiring drilling (%)	50
Table 1.5	Locations potentially installed by driven piling (%)	100
Table 1.5	Total drill arisings (m^3)	17,802
Table 1.5	Grout volume per foundation (piles) (m^3)	60
Table 1.5	Grout volume per foundation (screw piles) (m^3)	85

[iii] See the project description transcription clarification note (PINS Ref REP3-003)for how this has been assessed within the application.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.5	Hammer energy (kJ)	2,700
Table 1.5	Piling time per foundation (four pinpiles) (assuming issues such as low blow rate, refusal etc.) (hours)	10
Maximum design envelope for suction caisson jacket WTG foundations		
Table 1.6	Number of legs	4
Table 1.6	Separation of adjacent legs at seabed level (m)	40
Table 1.6	Separation of adjacent legs at Mean Sea Level (MSL) (m)	20
Table 1.6	Height of platform above HAT (m)	20
Table 1.6	Leg diameter (m)	3.5
Table 1.6	Suction buckets per foundation	4
Table 1.6	Suction bucket diameter (m)	20
N/A	Suction bucket footprint (m^2)	1,256.6
Table 1.6	Bucket penetration depth (below seabed) (m)	20
Table 1.6	Grout volume per foundation (m^3)	105
Table 1.6	Depth of seabed preparation (m)	3
Table 1.6	Area of seabed preparation per foundation (m^2)	3,200
Table 1.6	Volume per foundation for seabed preparation work (m^3)	9,600
Table 1.6	Volume for seabed preparation works (for WTG foundations only) (m^3)	268,800[iv]
Maximum design envelope for scour protection (based on suction caisson jacket foundations which represent the greatest scour protection requirement)		
Table 1.7	Median rock diameter (mm)	200
Table 1.7	Scour protection depth (rock) (m)	5
Table 1.7	Total scour protection area (WTG foundations only) (m^2)	219,912
Table 1.7	Scour protection diameter	5 x pile diameter
Table 1.7	Scour protection volume per foundation (m^3)	39,269.90[v]
Table 1.7	Scour protection total volume (WTG foundations only) (m^3)	1,112,647.40

[iv] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.

[v] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.

Project Description Chapter Ref	Parameter description	Maximum parameters
Paragraphs 1.4.52 to 1.4.55	Scour protection types	Rock placement, rock armour, frond mat systems
Maximum design envelope for the inter-array cables		
Table 1.8	System voltage (kV)	66
Table 1.8	External cable diameter (mm)	300
Table 1.8	Total length of inter-array cables (km)	64
Table 1.8	Maximum burial depth (m)	3
Table 1.8	Minimum burial depth (m)	0
Table 1.8	Trench width (m)	1
Paragraph 1.4.60	Pre-lay grapnel runs	Pre-Lay Grapnel Runs (PLGR) will be conducted to remove seabed surface debris along a 1 – 2 m wide area. The grapnel typically penetrates the seabed to 0.5 m depth and is selected and configured in accordance with the seabed conditions.
Maximum design envelope for inter-array cable installation		
Table 1.9	Burial technique	Jetting/ Ploughing/ Trenching/ Cutting/ Mass Flow Excavation/ Pre-sweeping (dredging)
Table 1.9	Length of inter-array cables (km)	64
Table 1.9	Maximum burial depth (m)	3
Table 1.9	Minimum burial depth (m)	0
Table 1.9	Percentage cable requiring additional protection (%)	25
Table 1.9	Length of cable requiring additional protection (m)	16,000
Table 1.9	Indicative trench width (m)	1
Table 1.9	Width of disturbance from jetting (m)	5
Table 1.9	Area of disturbance from jetting (km^2)	0.3

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.9	Width of disturbance from ploughing (m)	10
Table 1.9	Area of disturbance from ploughing (km^2)[vi]	0.064
Table 1.9	Width of rock berm protection (m)	5
Table 1.9	Area of cable protection excluding crossings (m^2)	80,000
Table 1.9	Height of rock berm protection (m)	0.5
Table 1.9	Volume of surface protection per km (based on a 0.5 x 5, trapezoid) (m^3 km^{-1})	1,250
Table 1.9	Length of exposed cable approaching WTG foundation requiring rock dumping/ remedial protection (m)	50
Table 1.9	Total area of WTG foundations requiring rock dumping/ remedial protection (m^2) (34 WTG and one OSS foundation)	17,500[vii]
Maximum design envelope for inter-array cable crossing protection		
Table 1.10	Crossing technique	Rock dumping/ concrete mattresses/ steel bridging/ concrete bridging
Table 1.10	Number of cable crossings	12
Table 1.10	Length of crossings (m)	100
Table 1.10	Width of crossings (m)	10
Table 1.10	Volume of post-lay rock berm protection per cable crossing (m^3)	500
Table 1.10	Number of concrete mattresses (6 x 3 x 0.3 m) per crossing	24
Table 1.10	Area of post-lay rock berm protection per cable crossing (m^2)	1,000
Table 1.10	Total area of rock berm protection for crossings (m^2)	12,000
Table 1.10	Total volume of rock berm protection for crossings (m^3)	6,000
Maximum design envelope for the OSS		
Table 1.11	Topside weight (tonnes)	2,500
Table 1.11	Topside length (m)	70

[vi] This was presented in the project description chapter as 0.06 km^2 as a rounding error. Please see Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) .

[vii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.11	Topside width (m)	50
Table 1.11	Topside height (excluding crane and helideck) (m)	30
Table 1.11	Topside height above HAT (excluding crane and helideck) (m)	55
Table 1.11	Topside height above HAT (including crane) (m)	80
Table 1.11	Annual O&M time (weeks)	2
Table 1.11	Diesel fuel (l)	200,000
Table 1.11	Gray water (m^3)	1,000
Table 1.11	Black water (m^3)	1,000
Table 1.11	Transformer coolant oil (kg)	600,000
Table 1.11	UPS Batteries (l)	10
Table 1.11	Fire suppression systems (l)	20,000
Table 1.11	Sulphur hexafluoride (SF6) (kg)	1,500
Table 1.11	Engine oil (m^3)	5
Table 1.11	HVAC coolant (glycol) (m^3)	5
Maximum design envelope for the installation of the OSS using driven monopiles		
Table 1.12	Pile diameter (m)	10
Table 1.12	Pile penetration depth (m)	50
Table 1.12	Hammer energy (kJ)	5,000
Table 1.12	Piling time per foundation (hr)	6
Table 1.12	Foundations by driven piling (%)	100
Table 1.12	Foundations installed by drilling (%)	50
Table 1.12	Drill diameter (m)	6
Table 1.12	Volume of risings per pile (m^3)	1,000[viii]
Table 1.12	Grout volume per foundation (m^3)	160
Table 1.12	Scour protection options [ix]	Rock placement, rock armour, frond mat systems
Table 1.12	Scour protection depth (m)	5

[viii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.
[ix] In project description chapter states to be the same as WTG foundations. It has been repeated in this table for clarity.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.12	Scour protection area (excluding structure footprint (m^2)	1,964[x]
Table 1.12	Topside indicative installation time excluding cable installation (from arrival on site) (weeks)	1
Maximum design envelope for the installation of the OSS using driven tripod jacket		
Table 1.12	Pile diameter (m)	3
Table 1.12	Pile penetration depth (m)	70
Table 1.12	Width of jacket at seabed (m)	36
Table 1.12	Width of jacket at MSL (m)	28
Table 1.12	Jacket leg spacing (m)	34
Table 1.12	Hammer energy (kJ)	2,700
Table 1.12	Piling time per foundation (hr)	6
Table 1.12	Foundations by driven piling (%)	100
Table 1.12	Foundations installed by drilling (%)	100
Table 1.12	Drill diameter (m)	4
Table 1.12	Volume of risings per pile (m^3)	200
Table 1.12	Volume of risings per OSS foundation (m^3)	450
Table 1.12	Grout volume per foundation (m^3)	100
Table 1.12	Scour protection options [xi]	Rock placement, rock armour, frond mat systems
Table 1.12	Scour protection depth (m)	5
Table 1.12	Scour protection area (excluding structure footprint (m^2)	2,025
Table 1.12	Topside indicative installation time excluding cable installation (from arrival on site) (weeks)	1
Maximum design envelope for the installation of the OSS using a suction caisson jacket		
Table 1.13	Suction bucket foundation leg diameter above sea surface (m)	3
Table 1.13	Suction bucket diameter (m) (Note: for tripod foundation)	20
N/A	Suction bucket footprint (m^2)	942.5

[x] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.

[xi] In project description chapter states to be the same as WTG foundations. It has been repeated in this table for clarity.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.13	Bucket penetration depth (m)	15
Table 1.13	Grout volume per foundation (m^3)	200
Table 1.13	Total grout volume for OSS (m^3)	800
Table 1.13	Scour protection options [xi]	Rock placement, rock armour, frond mat systems
Table 1.13	Scour protection depth (rock) (m)	5
Table 1.13	Scour protection area (including structure footprint (m^2)	7,854
Maximum design envelope for the offshore Meteorological Mast (Met Mast)		
Table 1.14	Maximum elevation (mHAT)	140 (Maximum hub height of WTGs)
Table 1.14	Met Mast spacing	The Met Mast follows the minimum spacing of the 716 m x 480 m.
Table 1.14	Hazardous materials (litres)	0
Table 1.14	Indicative number of yearly O&M visits	15
Table 1.14	Indicative instruments	Anemometers and wind vanes at a minimum of three measurement heights.
Additional assumptions applied within the ES for the Met Mast – Monopile foundation		
Assumptions taken from monopile WTG foundations – Table 1.6	Diameter of monopile (bottom) (m)	Max 10
	Volume of drill arisings per pile (m^3)	1,325[xii]
	Locations requiring drilling (%)	100
	Locations potentially installed by driven piling (%)	100
	Hammer energy (kJ)	5,000
	Number of blows per foundation	8,000
	Piling time per foundation (assuming issues such as low blow rate, refusal etc.) (hours)	6
Additional assumptions applied within the ES for the Met Mast –Suction Caisson foundation		
Assumptions taken from	Number of legs	4
	Suction bucket diameter (m)	20

[xii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.

Project Description Chapter Ref	Parameter description	Maximum parameters
suction caisson WTG foundations – Table 1.6	Depth of seabed preparation (m)	3
	Area of seabed preparation per foundation (m^2)	3,200
	Volume per foundation for seabed preparation work (m^3)	9,600
Assumptions taken from suction caisson WTG foundations – Table 1.7	Scour protection depth (rock) (m)	5
	Scour protection diameter	5 x pile diameter
	Scour protection area[xiii]	7,854
	Scour protection volume per foundation (m^3)	39,269.90
	Scour protection types	Rock placement, rock armour, frond mat systems
Additional assumptions applied within the ES for the Met Mast –Jacket foundation		
Assumptions taken from jacket WTG foundations – Table 1.5	Number of legs per foundation	4
	Separation of adjacent legs at seabed level (m)	40
	Leg diameter (m)	3.5
	Embedment depth (below seabed) (m)	70
	Volume of drill arisings per foundation (four pin-piles) (m^3)	1,400
	Locations requiring drilling (%)	100
	Locations potentially installed by driven piling (%)	100
	Total drill arisings (m^3)	1,400
	Grout volume per foundation (piles) (m^3)	60
	Grout volume per foundation (screw piles) (m^3)	85
	Hammer energy (kJ)	2,700
	Piling time per foundation (four pinpiles) (assuming issues such as low blow rate, refusal etc.) (hours)	10
Maximum design envelope for offshore export cables		
Table 1.15	Cable specification	3-core XLPE (Cross-linked Polyethylene) or similar.
Table 1.15	Cable voltage (kV)	220 kV
Table 1.15	Indicative external cable diameter (mm)	300

[xiii] Not presented within the project description but used within assessments. See Table 3 for further clarification.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.15	Length of cables (km)	30 per cable
Table 1.15	Total length of cables (km)	120
Table 1.15	Indicative expected duration of installation activities (days)	30 days per cable
Table 1.15	Indicative spacing between cables if unbundled (m)	50 m within pair; 120 m between pairs
Table 1.15	Spacing between adjacent cables if multiple cables (m)	250
Table 1.15	Trench width per cable (jetting) (m)	10
Maximum design envelope for offshore export cable installation		
Table 1.16	Maximum Burial depth (m)	3 below mean seabed depth
Table 1.16	Minimum Burial depth (m)	0
Table 1.16	Indicative trench width from jetting (m)	10
Table 1.16	Width of disturbance from jetting (m)	10
Table 1.16	Total area of disturbance from jetting (km^2)	1.2 (0.3 km^2 per cable)
Table 1.16	Width of disturbance from ploughing (m)	12
Table 1.16	Area of disturbance from ploughing (km^2)	1.4
Table 1.16	Pre-sweeping (sand wave clearance) length (dredging) (km)[xiv]	24 (6 km per cable)
Table 1.16	Pre-sweeping (sand wave clearance) width of dredging corridor (m)	20
Table 1.16	Pre-sweeping (sand wave clearance) area of dredging corridor (km^2)	0.48 (24 km x 20 m)
Table 1.16	Pre-sweeping (sand wave clearance) volume of dredging corridor (m^3)	1,440,000
Table 1.16	Pre-lay grapnel run width (m)	20
Table 1.16	Pre-lay grapnel run area (km^2)	2.4
Table 1.16	Width of cable protection per cable (m)	7
Table 1.16	Percentage of each cable requiring protection (%)	25
Table 1.16	Length of cable protection (m)	7,500
Table 1.16	Area of cable protection per export cable (m^2)	52,500
Table 1.16	Total area of cable protection (excluding cable crossings) (m^2)	210,000

[xiv] See Table 3 for further details of the proposed disposal locations of the material generated from sand wave clearance.

Project Description Chapter Ref	Parameter description	Maximum parameters
Maximum design envelope for cable crossings for the offshore export cables		
Table 1.17	Number of crossing	20
Table 1.17	Total number of crossings Assuming a four-cable scenario	80
Table 1.17	Length of crossings (m)	100
Table 1.17	Width of crossings (m)	10
Table 1.17	Post-lay berm height (m)	0.5
Table 1.17	Volume of post-lay rock berm protection per crossing (m^3)	500
Table 1.17	Number of concrete mattresses (6.0 x 3.0 x 0.3 m) per crossing	50
Table 1.17	Area of post-lay rock berm protection per cable crossing (m^2)	1000
Not presented in the project description as a total but calculated from the parameters outlined above from Table 1.17.	Total area of protection from export cable crossings (m^2)	80,000
Maximum design envelope for open trenching within the intertidal area		
Table 1.18	Open trench length per cable circuit (km)	2
Table 1.18	Open trench depth (m)	3
Paragraph 1.4.95 and Figure 1.16	Trench separation and associated temporary route tracks (m)	5
Table 1.18	Width of cable route (based on 4 cable circuits, temporary route tracks and sediment storage) (m)	40
Table 1.18	Area of disturbance (m^2) for four cable circuits	80,000
Maximum design envelope for HDD landfall option (Option 1)		
Table 1.19	Temporary works compound area (m)	60 x 50
Table 1.19	Onshore cofferdam area (m^2)	704
Table 1.19	Excavated material from landfall/ TJBs (HDD) (m^3)	1,408

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.19	Offshore cofferdam area (m^2)	1,600 (20 m x 20 m per cable with a maximum of 4 cables)
Table 1.19	Minimum punch out distance from sea wall (m)	100
Table 1.19	Volume of drilling mud volume to be released to environment (m^3)	(All drilling mud to be captured within cofferdam or other structure)
Table 1.19	Works duration (months)	18
Maximum cofferdam and trenched cable installation design parameters (Option 3)		
Table 1.20	Width of cofferdam (m)	165
Table 1.20	Depth of cofferdam (m)	25
Table 1.20	Temporary works compound area (m)	40 x 30
Table 1.20	Construction space required in saltmarsh (m^2)	3,872[xv]
Table 1.20	Piling Noise level (dBA)	132
Table 1.20	Duration of piling (days)	33
Paragraph 1.4.109	Maximum distance of TJBs from the existing sea wall (m)	350
UXO assumptions		
Table 1.21	Number of UXO	30
Table 1.21	Clearance/ Removal date (dependent on final construction programme)	2020
Table 1.21	Days to clear (based on 4 per day)	8
Table 1.21	Detonations per 24 hr period	8
Table 1.21	Minimum charge weight anticipated (kg)	0.5
Table 1.21	Maximum charge weight anticipated (kg)	130
Maximum construction vessel quantities on-site at the same time		
Table 1.22	Seabed preparation vessels	3
Table 1.22	Foundation spreads per project	1
Table 1.22	Number of vessels per foundation spread (includes tugs and feeders)	5
Table 1.22	Transition piece installation vessels	2
Table 1.22	Scour Installation Vessels	6

[xv] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application.

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.22	Number of vessels engaged in foundations	5
Table 1.22	Wind turbine installation spreads	3
Table 1.22	Max vessels per WTG installation spread	3
Table 1.22	Total WTG installation vessels	6
Table 1.22	Commissioning vessels	7
Table 1.22	Accommodation vessels	1
Table 1.22	Total IA cable vessels	4
Table 1.22	Number of Export Cable spreads per Project	3
Table 1.22	Number of vessels per Export Cable spread	2
Table 1.22	Total export cable vessels	6
Table 1.22	Landfall cable installation vessels	2
Table 1.22	Substation/ collector IV	3
Table 1.22	Other vessels	3
Table 1.22	Total	48
Construction period I&O Vessels Round Trips to Port for Project over 3 years		
Table 1.23	Seabed Preparation Vessel	15
Table 1.23	Foundation Installation Spread	60
Table 1.23	Transition Piece Installation	30
Table 1.23	Scour Vessel	30
Table 1.23	WTG Installation Spread	23
Table 1.23	Commissioning Vessels	480
Table 1.23	IA Cable Vessels	60
Table 1.23	Export Cable Vessels	300
Table 1.23	Landfall Cable Installation Vessels	30
Table 1.23	Substation Installation Vessels	12
Table 1.23	Other Vessels	120
Table 1.23	Total	1,160
Construction period I&O Vessels Round Trips to Port for Project over 3 years		
Table 1.24	Foundation Delivery	30
Table 1.24	Turbine Delivery	15
Table 1.24	Cable Delivery	30

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.24	Scour Delivery	30
Table 1.24	Substation Delivery	3
Table 1.24	Total	108
Jack-up Vessels		
Construction		
Table 1.25	Individual leg diameter (m)	10
Table 1.25	Individual leg footprint area (m^2)	78.54
Table 1.25	Number of legs	6
Table 1.25	Combined leg area (m^2)	471.24
Table 1.25	Leg penetration range	15
Table 1.25	Jacking Operations per	2
Table 1.25	Turbine sites	34
Table 1.25	Total JUV visits	68
O&M		
Table 1.25	Individual leg diameter (m)	6
Table 1.25	Individual leg footprint area (m^2)	28.27
Table 1.25	Number of legs	6[xvi]
Table 1.25	Combined leg area (m^2)	169.65
Table 1.25	Leg penetration range	15
Table 1.25	Jacking Operations per Turbine	10
Table 1.25	Turbine sites	34
Table 1.25	Total JUV visits	340
Decommissioning		
Table 1.25	Individual leg diameter (m)	6
Table 1.25	Individual leg footprint area (m^2)	28.27
Table 1.25	Number of legs	4
Table 1.25	Combined leg area (m^2)	113.1
Table 1.25	Leg penetration range	15
Table 1.25	Jacking Operations per Turbine	1

[xvi] The values were incorrectly presented within the project description chapter for Table 1.25. The values presented in Table 1.34 were however presented correctly. Please see Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003).

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.25	Turbine sites	34
Table 1.25	Total JUV visits	34
Anchor footprints for construction of Thanet Extension		
Installation of foundations		
Table 1.26	Number of anchors for assumed construction vessel	6
Table 1.26	Individual anchor footprint area for one deployment and recovery (m^2)	25
Table 1.26	Indicative anchor penetration depth (m)	3
Table 1.26	Impacted anchor area for one deployment (m^2)	150
Table 1.26	Assumed number of anchoring operations per installation	1
Table 1.26	Total impacted area (m^2)	150
Table 1.26	Total impacted volume (m^3)	450
Installation of topside (WTG and tower)		
Table 1.26	Number of anchors for assumed construction vessel	4
Assumptions applied in the ES based upon the installation of foundations in Table 1.26.	Individual anchor footprint area for one deployment and recovery (m^2)	25
	Indicative anchor penetration depth (m)	3
	Impacted anchor area for one deployment (m^2)	150
	Assumed number of anchoring operations per installation	1
	Total impacted area (m^2)	150
	Total impacted volume (m^3)	450
Installation of topside (OSS)		
Table 1.26	Number of anchors for assumed construction vessel	6
Table 1.26	Individual anchor footprint area for one deployment and recovery (m^2)	25
Table 1.26	Indicative anchor penetration depth (m)	3
Table 1.26	Impacted anchor area for one deployment (m^2)	150
Table 1.26	Assumed number of anchoring operations per installation	1
Table 1.26	Total impacted area (m^2)	150
Table 1.26	Total impacted volume (m^3)	450

Project Description Chapter Ref	Parameter description	Maximum parameters
Installation of export cables		
Table 1.26	Number of anchors for assumed construction vessel	6
Table 1.26	Individual anchor footprint area for one deployment and recovery (m^2)	10
Table 1.26	Indicative anchor penetration depth (m)	3
Table 1.26	Impacted anchor area for one deployment (m^2)	60
Table 1.26	Assumed number of anchoring operations per cable installation	120
Table 1.26	Anchor deployments per asset crossing (per cable)	4
Table 1.26	Total anchor deployments for asset crossings (per cable)	20
Table 1.26	Anchor deployments per cable and foundation interface (per cable)	4
Table 1.26	Total anchor deployments per cable installation	144
Table 1.26	Impacted area per cable (m^2)	8,640
Table 1.26	Impacted volume per cable (m^3)	25,920
Table 1.26	Total impacted area (m^2)	34,560
Table 1.26	Total impacted volume per cable (m^3)	103,680
Installation of array cables		
Table 1.26	Number of anchors for assumed construction vessel	6
Table 1.26	Individual anchor footprint area for one deployment and recovery (m^2)	10
Table 1.26	Indicative anchor penetration depth (m)	3
Table 1.26	Impacted anchor area for one deployment (m^2)	60
Table 1.26	Assumed number of anchoring operations per installation	15
Table 1.26	Number of installations	34
Table 1.26	Total anchor deployments for inter-array installation	510
Table 1.26	Impacted area per cable (m^2)	900
Table 1.26	Impacted volume per cable (m^3)	2,700
Table 1.26	Total impacted area (m^2)[xvii]	30,600

[xvii] Discrepancies in this value within the ES are accounted for in Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003).

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.26	Total impacted volume (m^3)	91,800
Permanent vessel moorings[xviii]		
Table 1.27	Number of installations in total	2
Table 1.27	Possible foundation types	Concrete Gravity Base or Standard Ground Tackle
Table 1.27	Surface structure	A floating mooring buoy up to 3 m in diameter, and 3 m above sea level.
Table 1.27	Marking & Lighting	Marked and lit as required (assume high-viz yellow colouration, radar reflector, navigation light). AIS beacon may be considered judged valuable (and acceptable to THLS).
Indicative construction programme (assuming no breaks to work)		
Table 1.28	Foundation installation	6 (includes 1 month weather downtime)
Table 1.28	Cable installation (inter-array and export)	6 (includes 1 month weather downtime)
Table 1.28	OSS (if required)	2.5 (includes 2 weeks for foundation installation and weather downtime)
Table 1.28	Met Mast (if required)	2.5 (includes 2 weeks for foundation installation and weather downtime)
Table 1.28	WTG installation	6 (includes 1 month weather downtime)
Table 1.28	Scour protection installation	1 (includes 2 weeks weather downtime)
Table 1.28	Total duration	28
Maximum O&M vessel quantities per year		
Table 1.29	Small CTV O&M vessel	2

[xviii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003).

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.29	Large O&M Vessel	1
Table 1.29	Lift vessels	1
Table 1.29	Cable maintenance vessel	1
Table 1.29	Auxiliary vessels	1
O&M Vessel Round Trips to Port per year, per vessel[xix]		
Table 1.30	Small CTV O&M vessel	300
Table 1.30	Large O&M Vessel	2
Table 1.30	Lift vessels	1
Table 1.30	Cable maintenance vessel	1
Table 1.30	Auxiliary vessels	3
Table 1.30	Accommodation O&M	0
Table 1.30	Total (including all vessels)	307
O&M estimations – inter-array cables replacement worst-case estimates[xx]		
Table 1.31	Number of inter-array cable failure during lifetime of wind farm	7
Table 1.31	Length of replacement (longest inter-array cable) (m)	2,000
Table 1.31	Width of seabed being disrupted for replacement of inter-array cable (m)	10
Table 1.31	Overall impact area (cable and JUV) per repair (m^2)[xxi]	20,000
Table 1.31	Total repair area (m^2)[xxii]	140,000
O&M estimations – inter-array cables repair worst-case estimates [xx]		
Table 1.32	Cable re-burial - Reburial (total inter-array length) (m)	64,000
Table 1.32	Cable re-burial - Frequency (once every 5 years)	6
Table 1.32	Cable repair - Total width of disturbance (m)	10
Table 1.32	Cable repair - Total area (cable alone) (m^2)	640,000

[xix] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) with respect to O&M vessels quantities assessed within the ES.
[xx] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) with respect to O&M cable activities assessed within the ES.
[xxi] This value was incorrectly presented in the project description chapter as 140,000. Please see Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003).
[xxii] This value was incorrectly presented in the project description chapter as 980,000. Please see Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003).

Project Description Chapter Ref	Parameter description	Maximum parameters
Table 1.32	Overall cumulative impact area (cable +JUV) per repair (m^2)	3,840,000
Export cable repairs/ reburial worst-case estimates [xx]		
Table 1.33	Cable inspection- One failure per cable per 5 years (total repairs in lifetime of project)	24
Table 1.33	Cable inspection- Assumed repair length (through removal) (m)	300
Table 1.33	Cable burial using surface protection- Total width of disturbance (same method as installation but decreased from 30 to 10 m) (m)	10
Table 1.33	Cable re-burial Total area (cable alone) (m^2)	3,000
Table 1.33	Additional cable laying- Overall cumulative impact area (cable +JUV) per repair (m^2)	72,000
WTGs O&M worst-case estimates		
Table 1.34	Individual leg diameter (m)	6
Table 1.34	Individual leg footprint area (m^2)	28.27
Table 1.34	Number of legs	6
Table 1.34	Combined leg area (m^2)	169.65
Table 1.34	Leg penetration range	15.00
Table 1.34	Jacking Operations per Turbine (1 visit every 3 years)	10
Table 1.34	Turbine sites	34
Table 1.34	Total operations	340
Table 1.34	Total footprint during operational period (m^2)	57,680
OSS O&M worst-case estimates		
Table 1.35	Individual leg diameter (m)	6
Table 1.35	Individual leg footprint area (m^2)	28.27
Table 1.35	Number of legs	6
Table 1.35	Combined leg area (m^2)	169.65
Table 1.35	Leg penetration range	15
Table 1.35	Jacking Operations (total) (1 visit every 2 years)	12.5
Table 1.35	OSS sites	1
Table 1.35	Total operations	13
Table 1.35	Total footprint during operational period (m^2)	2,121

Table 2: Maximum Disposal Volumes (sand wave and seabed preparation of suction caisson foundations) for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Volume (m^3)
Transmission	Table 1.16 and assumptions of WTGs foundations were applied for the OSS (Table 1.6). Table 1.16 presented the pre-sweeping assumptions for the cable corridors.	Pre-sweeping (sand wave clearance) and seabed preparation for OSS suction caisson foundation	1,440,000 + 9,600 = 1,449,600
Generation	Table 1.6 and assumptions of WTGs foundations were applied for the met mast (Table 1.6)	Seabed preparation for suction caisson foundations (28 WTGs and a met mast)	29 x 9,600 = 278,400
Total			1,728,000

Table 3: Maximum Disposal Volumes (sand wave and drill arisings for monopile foundations[xxiii]) for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Volume (m^3)
Transmission	Tables 1.12 and 1.16	Pre-sweeping (sand wave clearance) and drill arisings for OSS monopile foundation	1,440,000 + 1,000= 1,441,000
Generation	Table 1.4 and assumptions of WTGs foundations were applied for the met mast (Table 1.4)	Drill arisings for monopile foundations (28 WTGs and a met mast)	19,627 + 1,155 = 20,782
Total			1,461,782 (1,440,000 + 21,782)

[xxiii] See Table 9 for details of how the drill arising volumes have been derived.

Table 4: Summary of the total maximum disposal volumes (sandwave and seabed preparation or drill arisings) in the proposed disposal sites (as presented in Appendix 27 of the Applicant's Deadline 5 Submission)

Disposal Site	Total volume to be disposed of in the site from cable sand wave clearance, suction caisson seabed preparation and monopile drill arisings (m^3)
1	594,240 (360,000 + 230,400) for seabed preparation/sandwave clearance relating to cable works, and suction caisson foundations respectively; or 371,968.5 (360,000 +9,813.5+1,000+1,155) for sandwave clearance relating to cable works, monopile drilling, offshore substation and metmast drilling respectively
2	432,960 (360,000 + 76,800) for seabed preparation/sandwave clearance relating to cable works, and suction caisson foundations respectively; or 371,968.5 (360,000 +9,813.5+1000+1,155) for sandwave clearance relating to cable works, monopile drilling, offshore substation and metmast drilling respectively
3	720,000 (50% of the total)
Total (m^3):	1,728,000 (1,440,000 + 288,000) in the case of dredging[xxiv]; or 1,461,782 (1,440,000 + 21,782) in the case of monopile drilling[xxv].

Table 5: Maximum scour protection area for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Area (m^2)
Transmission	Table 1.13	Scour protection for the OSS	7,854
Generation	Table 1.7 and assumptions of WTGs foundations were applied for the met mast (Table 1.7)	Scour protection for WTGs and the met mast	219,912 + 7,854 = 227,766
Total			235,620

[xxiv] See Table 2 for details of how the drill arising volumes have been derived.
[xxv] See Table 3 for details of how the drill arising volumes have been derived.

Table 6: Maximum scour protection volume for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Volume (m^3)
Transmission	The assumptions of WTGs foundations were applied for the OSS (Table 1.7)	Scour protection for OSS	39,269.9
Generation	Table 1.7 and assumptions of WTGs foundations were applied for the met mast (Table 1.7)	Scour protection for the WTGs and the met mast	1,112,647.4 + 39,269.9 = 1,151,917.3
Total			1,191,187.2

Table 7: Maximum cable protection area for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Area (m^2)
Transmission	Table 1.16	Export Cable	210,000
	Table 1.17	Export Cable crossings	80 crossings x 1000 = 80,000
	Not presented as a total in the project description	Total for Export Cable	290,000
Generation	Table 1.9	Inter-array cables	80,000
	Table 1.10	Inter-array cables crossings	12,000
	Table 1.9	Total area of WTG foundations requiring rock dumping/ remedial protection (m_2)	17,500 – 500 =17,000
	Not presented as a total in the project description	Total for inter-array cables	109,000
Total			399,000

Table 8: Maximum cable protection volume for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Area (m^3)
Transmission	Table 1.16	Export Cable	210,000 m^2 x 0.5 m = 105,000 m^3
	Table 1.17	Export Cable crossings	80 crossings x 500m^3 = 40,000 m^3

	Not presented as a total in the project description	Total for Export Cable	145,000 m^3
Generation	Table 1.9	Total area of WTG foundations requiring rock dumping/ remedial protection (m_2)	17,500 m^2 x 0.5 m = 8,750 m^3
	Table 1.9	Inter-array cables	16 km x 1,250 m^3 km^{-1} = 20,000 m^3
	Table 1.10	Inter-array cables crossings	6,000
	Not presented as a total in the project description	Total for inter-array cables	34,750
Total			179,750

Table 9: Maximum drill arising volume for Thanet Extension

Infrastructure	Project Description Chapter Ref	Activity	Maximum Volume (m^2)
Transmission	Table 1.12	Maximum volume for to drill OSS	1,000
Generation	Table 1.4 and assumptions of WTGs foundations were applied for the met mast (Table 1.4)	Maximum volume to drill 50% of WTG foundations and one met mast (assuming 10MW)	19,627 + 1,155 = 20,782
Total			21,782[xxvi]

Table 10: Maximum disturbance sediment volume for installation of cabling for Thanet Extension (excluding pre-sweeping/ sand wave clearance)

Infrastructure	Project Description Chapter Ref	Activity	Maximum Volume (m^3)
Transmission	Table 1.16	Jetting of export cables (assuming a v-shaped trench and 50% of sediment is liquidised)	10 m x 3 m x 120 km x 0.5 x 50% = 900,000[xxvii]

[xxvi] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application. This value was not presented as total within the project description chapter.

[xxvii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application. This value was not presented as total within the project description chapter.

Generation	Table 1.9	Jetting of inter-array cables (assuming a v-shaped trench and 50% of sediment is liquidised)	1 m x 3 m x 64 km x 0.5 x 50% = 48,000[xxviii]
Total			948,000

Table 11: *Maximum disposal volumes from cable related sand wave clearance*

Infrastructure	Project Description Chapter Ref	Activity	Maximum Volume (m^3)
Transmission	Table 1.16	Maximum disposal volumes from cable related sand wave clearance	24 km x 20 m x 60 m^3/m = 1,440,000 m^3
Generation	N/A	N/A	N/A
Total			1,440,000 m^3

Table 12: Maximum infrastructure footprint for Thanet Extension Construction activities

Infrastructure	Project Description Chapter Ref	Activity	Maximum Area (m^2)
Transmission	Based on parameters from Table 1.13	One OSS (based on a tripod suction bucket diameter of 20 m)	942.5[xxix]
Generation	Based on parameters from Table 1.6	28 x 12 MW WTGs and one met mast with a diameter of 20 m (assuming the same parameters as WTGs)	1,256.6 x 29 = 36,442.5
Total			37,385[xxx]

Table 13: Maximum disturbance area for Thanet Extension O&M activities

Infrastructure	Project Description Chapter Ref	Activity	Maximum Area (m^2)
Transmission	Table 1.33	Export Cable O&M works	72,000
	Table 1.35	JUVs for OSS	2,121
	N/A	Transmission Total	74,121

[xxviii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application. This value was not presented as total within the project description chapter.

[xxix] This is based on a tripod OSS as within the project description chapter, however this has been assessed as 1,256 m^2 within the ES.

[xxx] Based on the discrepancy between the footprint for the OSS, this has been assessed as 37,680 m^2 within the ES. Please see Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003).

Generation	Tables 1.31 & 1.32	Inter-array cable O&M replacement and reburial	140,000 + 3,840,000 = 3,980,000
	Table 1.25	JUVs for WTGs	169.65 x 340 = 57,680
	N/A	Generation Total	4,037,860
Total			4,111,801[xxxi]

[xxxi] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application. This value was not presented as total within the project description chapter.

Table 14: Maximum disturbance volume for Thanet Extension O&M activities

Infrastructure	Project Description Chapter Ref	Activity	Maximum Area(m^2)
Transmission	Table 1.33	Export Cable O&M works	72,000 m^2 x 3m x 0.5 x 50% = 54,000
Generation	Tables 1.31 & 1.32	Inter-array cable O&M replacement and reburial	3,980,000 m^2 x 3m x 0.5 x 50% = 2,985,000
Total			3,039,000[xxxii]

[xxxii] See Annex A to Appendix 1 of the Applicant's Deadline 3 Submission (PINS Ref REP3-003) for how this has been assessed within the application. This value was not presented as total within the project description chapter.