codling wind park

Environmental Impact Assessment Report

Volume 4

Appendix 9.2 Representative Scenario and Limits of Deviation Assessment


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APPENDIX 9.2 REPRESENTATIVE SCENARIO AND LIMITS OF DEVIATION ASSESSMENT

1 Introduction

1. Complex, large-scale infrastructure projects with a terrestrial and marine interface such as the CWP Project, are consented and constructed over extended timeframes. The ability to adapt to changing supply chain, policy or environmental conditions and to make use of the best available information to feed into project design, promotes environmentally sound and sustainable development. This ultimately reduces project development costs and therefore electricity costs for consumers and reduces CO_2 emissions.

2. Case law recognises that the plans and particulars submitted with planning applications can allow for a certain limited flexibility, where this is applied reasonably and, in a context-specific way. In addition, section 287A of the PDA (as inserted by the Planning and Development, Maritime and Valuation (Amendment) Act 2022) has expanded the flexibility available and allows planning applications to be made and decided before the Applicant has confirmed certain details of the project.

3. Due to the complexity of the CWP Project, significant and rapid progression in wind farm technology development, potential changes in environmental conditions and in policy and legislation, CWPL considers that consenting a degree of design flexibility is appropriate and legally compliant.

4. In this regard the approach to the design development of the CWP Project has sought to introduce flexibility where required to enable the best available technology to be constructed, whilst at the same time to specify project boundaries, project components and project parameters wherever possible, whilst having regard to known environmental constraints.

2 Approach to Presenting the Project Design

5. The approach to the design development of the CWP Project considers permanent infrastructure, temporary infrastructure and installation methods.

6. In general, the CWP Project has sought to specify the location, scale and extents of permanent and temporary infrastructure, however in some cases a degree of design flexibility is required. Subject to the detail concerned, this flexibility is presented in three ways:

   - **Options**: Consent is sought for up to two options for certain permanent infrastructure details and layouts, for example, WTG Layout Option A (250 m rotor diameter) or WTG Layout Option B (276 m rotor diameter). Each design option is described in detail in **Chapter 4 Project Description**, which provides the details associated with each option.

   - **Dimensional flexibility**: Dimensional flexibility is described as a limited parameter range i.e. upper (maximum) and lower (minimum) values for a given detail such as cable length.

   - **Locational flexibility**: Locational flexibility of permanent infrastructure is described as a Limit of Deviation (LoD) from a specific point or alignment.

7. Installation methods for permanent infrastructure have been identified and described in full, however, as with the design of permanent infrastructure, a degree of flexibility is required as final decisions on methods and techniques to be employed will not be made until the appointment of the primary contractors closer to the time of construction.

8. Where required, flexibility concerning installation methods is presented by means of options. The details associated with the installation methods are specified, where possible, or otherwise described as a limited parameter range i.e. upper (maximum) and lower (minimum) values for a given detail.

3 Representative Scenario Assessment

9. The CWP Project EIAR will identify, describe and assess all of the likely significant effects of the proposed development on the environment. To achieve this for all options and dimensional flexibility, and at the same time to produce application documents that are concise and readable, each chapter of the EIAR will assess a selection of representative scenarios, rather than assessing every possible scenario. A “representative scenario” is a combination of options and dimensional flexibility that has been selected to represent all of the likely significant effects of the project on the environment. Some topics may require several representative scenarios to be identified to ensure all impacts are identified, described and assessed.

10. For fish, shellfish and turtle ecology this analysis for construction and O&M phase impacts is presented in **Table 1** and **Table 2**, respectively. Each table identifies one or more representative scenarios for each impact with supporting text to demonstrate that no other scenarios would give rise to new or materially different effects; taking into consideration the potential impact of other scenarios on the magnitude of the impact or the sensitivity of the receptor(s) that is being considered.

11. Where the potential for a new or materially different impact is identified, then further representative scenarios must be assessed in full within the main chapter.

12. This is distinct from the approach to assessing locational flexibility, where differences in impacts are assessed in this Appendix. The difference in approaches arises because there is a much higher degree of confidence in the locations and alignments assessed in the main chapter than there is for the final options and dimensions.

13. Overall, this approach will ensure that the EIAR will identify, describe and assess:

- Every impact type that could arise from the proposed development, taking account of the full range of options and dimensional flexibility;
- Every materially different magnitude of impact that could arise from the proposed development within the proposed options and dimensional flexibility; and
- Every materially different sensitivity of receptor that could arise from the proposed development within the proposed options and dimensional flexibility.

Table 1 Representative scenario assessment - Construction phase impacts

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
Impact 1: Temporary seabed habitat disturbance	Array site (including WTGs, OSSs and offshore export cables within the array site) and offshore export cable corridor	WTG Option A	WTG Option B		Questions to demonstrate assessment has considered all scenarios	Response
	Installation methods and effects			The temporary disturbance relates to seabed preparation for foundations and cables, jack up and anchoring operations, and cable installation. It should be noted that where boulder clearance overlaps with sand wave clearance, the boulder clearance footprint will be within the sand wave clearance footprint. Offshore, WTG Option A forms the representative scenario as this represents the greatest level of temporary habitat disturbance, and therefore Option A forms the presentational basis of the assessment for Impact 1: temporary habitat disturbance in this chapter. Option B would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude. The total area of disturbed sediment for construction activities based on this representative scenario is calculated to be 12,088,840 m^2.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	1. No, WTG Option B would not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, the two layouts are highly unlikely to have differing magnitudes because the overall area of habitat disturbed is very similar between the two scenarios. 3. No, infrastructure layout will not influence the sensitivity of the receptor that is being assessed. 4.In relation to impact 1 there is no layout option that would introduce a material change in receptor sensitivity. 5. No, there are no additional installation methods that are likely to introduce a materially different magnitude. Additionally, any variation in installation methods is unlikely to have differing magnitudes. 6. No, the methods proposed will not influence the sensitivity of the receptor that is being assessed.
	Boulder clearance: Array site seabed clearance area (m^2)	2,556,000 - 2,934,000	2,494,000 - 2,772,000			
	Sand wave clearance: Array site seabed clearance area (m^2)	205,250 - 259,250	220,000 – 277,500			
	IAC and interconnector cable installation: Total seabed disturbed (m^2)	1,911,000 - 2,214,000	1,791,000 - 2,079,000			
	Boulder clearance: OECC seabed clearance area (m^2)	2,220,000 - 2,616,000	2,220,000 - 2,616,000			
	Sand wave clearance: OECC seabed clearance area (m^2)	198,550	198,550			
	Offshore export cable installation: Total seabed disturbed (m^2)	1,890,000 - 2,187,000	1,890,000 - 2,187,000			
	JUV operations total impact area (m^2)	240,000	180,000			
	WTGs and OSS anchoring operations total impact area (m^2)	280,800	237,600			
	IAC and interconnector cable anchoring operations total impact area (m^2)	371,520	280,800			
	Offshore export cable anchoring operations total impact area (m^2)	630,720	630,720			
	Total area of disturbed sediment for offshore construction activities (m^2)	**11,931,840**	**11,459,170**			
	Landfall	Open cut				
	Installation methods and effects					
	Total seabed disturbed by cofferdam (m^2)	6,100				
	Total seabed disturbed by intertidal cable duct installation (m^2)	36,000				
	Total area of seabed in transition zone affected by support structures (m^2)	6,900				
	Total area of seabed in transition zone affected by installation of cables using either open cut trenching or a shallow water trenching tool (m^2)	108,000				

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
	Total area of disturbed sediment for landfall construction activities (m^2)	**157,000**				
Impact 2: Noise and vibration	Array site (including WTGs, OSSs and offshore export cables within the array site) and offshore export cable corridor	WTG Option A	WTG Option B		Questions to demonstrate assessment has considered all scenarios	Response
	Installation method [WTG Pile driving]			Disturbance from noise and vibration relates to installation of the infrastructure foundations. Offshore, installation of infrastructure via pile driving forms the representative scenario as this represents the greatest level of temporary habitat disturbance, and therefore pile driving forms the presentational basis of the assessment for Impact 1: Noise and vibration in this chapter. Drilling would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude. Of the pile driving scenario, WTG Option A forms the representative scenario as this represents the greatest level of temporary habitat disturbance, and therefore Option A forms the presentational basis of the assessment for Impact 2: Noise and vibration in this chapter. Option B would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	1. No, there are no alternate infrastructure layouts that would introduce new impacts. Additionally for pile driving, WTG Option B would not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. Option A consists of 78 (WTG and OSS) days of piling when compared to 63 days for Option B. As Option A will be of longer duration, it forms the basis of the assessment. There is no other layout option that may introduce a larger magnitude of impact. 3. No, infrastructure layout will not influence the sensitivity of the receptor that is being assessed. 4. No, in relation to Impact 2, the installation method of drilling, other underwater noise, onshore substation piling, landfall piling, UXO clearance or geophysical survey noise are unlikely to introduce any new impact receptor pathways in regards of noise/vibration that have not already been considered as part of the assessment. Drilling and other underwater noise introduces a continuous rather than impulsive noise, although the types of effect and response seen in receptors are equivalent. Drilling does however also introduce the potential for increased SSC/deposition from drill arisings. This will be addressed under Impact 3. 5. No, pile driving represents the greatest magnitude of impact and drilling / other underwater noise or UXO clearance would not introduce a materially different level of magnitude that have not already been considered as part of the assessment. 6. No, the methods proposed will not influence the sensitivity of the receptor that is being assessed.
	Hammer energy (kJ)	440 - 4400	440 - 4400			
	Total hours of piling per monopile	3.5	3.5			
	Total no. of monopiles installed in 24hrs	1 - 2	1 - 2			
	Total no. of piling days	75	60			
	Total piling hours	262.5	210			
	Number of piles being installed simultaneously at any one time	1	1			
	Installation method [OSS Pile driving]					
	Hammer energy (kJ)	440 - 4400				
	Hours of piling per monopile	3.5				
	Number of monopiles installed in 24hrs	1-2				
	Total number of piling days	3				
	Total number of piling hours	10.5				
	Installation method [**Drilling**]	WTG Option A	WTG Option B			
	No. of monopile foundations	75	60			
	Number of locations that may require drilling	12	10			
	Drill diameter (m)	8.5	9			
	Drill penetration depth (m)	36.0	36.5			
	Volume of drill arisings per WTG foundation (m^3)	2,043	2,322			
	Total volume of drill arisings (m^3) (to be incorporated within the area of scour protection).	24,516	23,220			
	Installation method [onshore substation; Piling]			Of the onshore substation pile driving scenario, the option		

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
	Maximum length of combi-wall below the HWM (requiring marine piling)	150		where two piles are driven at the same time forms the representative scenario as this represents the greatest level of temporary habitat disturbance, and therefore forms the presentational basis of the assessment for Impact 2: Noise and vibration in this chapter. The single piling option would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude.		
	Max time to drive a single tubular pile (hours)	24 hours per group of 4-6 piles but not continuous 2 hours of pile driving per day for each pile using impact driving "				
	Max time to drive a single combi-wall sheet pile (hours)	2 hours per sheet pile using impact driving				
	Max time to drive a single anchor wall sheet pile (hours)	1 hour using impact piling.				
	Combi-wall – Maximum duration of pile driving in a single day (hours)	8 hours				
	Combi-wall tubular piles – Hammer energy (kJ)	400 KJ				
	Combi-wall tubular piles - blows per minute	100				
	Combi-wall sheet piles - Hammer energy (kJ)	400 KJ				
	Combi-wall tubular piles - blows per minute	100				
	Geophysical surveys			Geophysical survey requirements will be the same regardless of the WTG option selected. Therefore, there is only one scenario for this potential impact.		
	Array site and OECC Cable Lay Geophysical Survey Noise					
	Array Site and OECC UXO clearance Up to ten UXO have been identified as requiring clearance, with a maximum charge weight of up to 525 kg Net Explosive Quantity (NEQ) for 2,000 lb (907.2 kg) UXO. The UXO items considered most likely to be encountered within the offshore development area are listed below: • Mines Allied • Mines German • Large Bombs (500 lb or larger) • Small Bombs (250 lb or smaller) • Large Projectiles (6-inch – 16-inch) • Small Projectiles and Rockets (smaller than 6-inch) • Chemical Munitions • Depth Charges and Torpedoes • Land Service Ammunition	-	-	UXO clearance requirements will be the same regardless of the WTG option selected. Therefore, there is only one scenario for this potential impact.		

Impact	Relevant project details		Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
	• Small Arms Ammunition				
	Increased underwater noise from other construction-related activities e.g., route preparation, cable installation, trenching and cable protection	Same as Impact 1	Offshore, WTG Option A forms the representative scenario as this represents the greatest level of disturbance, and therefore Option A forms the presentational basis of the assessment for Impact 4. Option B would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude.		
Impact 3: Temporary disturbance of the seabed leading to increases in SSC and associated deposition	Same as impact 1		The temporary disturbance relates to the increase in suspended sediments and the associated deposition that arises from the installation of the infrastructure foundations. Offshore, disposal of dredged materials and the use of jetting to instal cables forms the representative scenario as this represents the greatest level of suspended sediments / deposition disturbance, and therefore forms the presentational basis of the assessment for Impact 3: temporary habitat disturbance in this chapter. Ploughing would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude. There is only one modelled scenario representing this impact, that takes into account the largest potential effect. Other scenarios would have a smaller footprint, resulting in a lesser level of impact.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of*	1. No, WTG Option B would not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, the two layouts are highly unlikely to have differing magnitudes because the overall area of habitat disturbed is very similar between the two scenarios. 3. No, infrastructure layout will not influence the sensitivity of the receptor that is being assessed. 4. No, there are no additional installation methods that could introduce new impacts. 5. No, there are no additional installation methods that are likely to introduce a materially different magnitude. 6. No, the methods proposed will not influence the sensitivity of the receptor that is being assessed.

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
					the relevant receptor(s) (greater or lesser).	
Impact 4: Collision with vessels	Peak vessels on site simultaneously	38		Offshore, WTG Option A forms the representative scenario as this represents the greatest level of potential collision risk as overall more vessels will be required, and therefore Option A forms the presentational basis of the assessment for Impact 4. Option B would result in a lower level of collision risk and would not introduce new impacts, or an impact of materially different magnitude.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	1. No, there are no alternate infrastructure layouts that would introduce new impacts. 2. There is no other layout option that may introduce a materially different magnitude of impact. 3. No, sensitivity of the receptor is not altered by changes in layout option. 4. No, changes in installation method is unlikely to introduce any new impact receptor pathways that have not already been considered as part of the assessment. 5. No, changes in installation method is unlikely to lead to a materially different magnitude of impact. 6. No, the variation in methods proposed will not influence the sensitivity of the receptor that is being assessed.
	Total Construction vessels	75				
	Round trips	2,409	2,387			
Impact 5: Pollution	Oils and fluids which may be used during construction activities include: • Grease • Hydraulic oil • Gear oil • Nitrogen • Transformer silicon / ester oil • Diesel fuel • SF6	Same as impact 4		The requirement for use of oils and fluids during construction will be the same regardless of the WTG option selected. However, WTG Option A forms the representative scenario as this represents the greatest level of potential pollution risk as overall more vessels will be required, and therefore Option A forms the presentational	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.*	1. No, there are no alternate infrastructure layouts that would introduce new impacts. 2. There is no other layout option that may introduce a materially different magnitude of impact. 3. No, sensitivity of the receptor is not altered by changes in layout option.

Impact	Relevant project details		Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
	• Glycol / Coolants • Batteries • Drill fluid		basis of the assessment for Impact 5. Option B would result in a lower level of pollution risk and would not introduce new impacts, or an impact of materially different magnitude.	*2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	4. No, changes in installation method is unlikely to introduce any new impact receptor pathways that have not already been considered as part of the assessment. 5. No, changes in installation method is unlikely to lead to a materially different magnitude of impact. 6. No, the variation in methods proposed will not influence the sensitivity of the receptor that is being assessed.
Impact 6: Non-native invasive species (INNS)	There is the potential that Invasive Non-Native Invasive Species (INNS) could be introduced by construction related activities, through methods such as the release of contaminated ship's ballast.	Same as impact 4	Offshore, WTG Option A forms the representative scenario as this represents the greatest level of disturbance as overall more vessels will be required, and therefore Option A forms the presentational basis of the assessment for Impact 6. Option B would result in a lower level of disturbance and would not introduce new impacts, or an impact of materially different magnitude.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?*	1. No, there are no alternate infrastructure layouts that would introduce new impacts. 2. There is no other layout option that may introduce a materially different magnitude of impact. 3. No, sensitivity of the receptor is not altered by changes in layout option. 4. No, changes in installation method is unlikely to introduce any new impact receptor pathways that have not already been considered as part of the assessment. 5. No, changes in installation method is unlikely to lead to a materially different magnitude of impact. 6. No, the variation in methods proposed will not influence the sensitivity of the receptor that is being assessed.

Impact	Relevant project details		Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
				4. Are there alternative installation methods which may introduce new impacts? *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	

Table 2 Representative scenario assessment - Operational phase impacts

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
Impact 1: Long term habitat loss	Array site (including WTGs, OSSs and offshore export cables within the array site) and offshore export cable corridor	WTG Option A	WTG Option B		Questions to demonstrate assessment has considered all scenarios	Response
	Permanent infrastructure			Long term habitat loss relates to permanent infrastructure that will be located on the seafloor during the operational phase of the windfarm. Offshore, WTG Option A forms the representative scenario as this represents the greatest level of permanent infrastructure, and therefore Option A forms the presentational basis of the assessment for Impact 7 in this chapter. Option B would result in a lower level of loss and would not introduce new impacts, or an impact of different magnitude. The total area of disturbed	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?*	1. No, WTG Option B would not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, the two layouts are unlikely to have differing magnitudes for Impact 1. Option A has a slightly larger area of habitat loss and therefore forms the basis for the assessment. 3. No, there are no infrastructure layouts that would influence the sensitivity of the receptor that is being assessed.
	Total WTG monopile seabed area take (with scour protection) across the array site (m^2)	273,000	218,400			
	Total OSS monopile seabed area take (with scour protection) across the array site (m^2)	10,920				
	Interconnector and inter-array Cable-total area of seabed covered by cable protection (m^2)-	208,600	208,600			
	Offshore export cables-total area of seabed covered by cable protection (m^2)	105,000				
	Area of reclaimed land from Liffey (m^2)	1,800				

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
	Total area of long-term habitat loss (m^2)	**599,320**	**530,720**	sediment for construction activities based on this representative scenario is calculated to be 599,320 m^2.	*4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	4. No, in relation to Impact 1, there are no layouts which may introduce new impacts. 5. No, there are no alternative installation methods which would introduce a materially different magnitude of impact. 6. No, there are no installation methods that will influence the sensitivity of the receptor that is being assessed.
Impact 2: Electromagnetic Fields (EMF) from cables	Array site (including WTGs, OSSs and offshore export cables within the Array Site) and Offshore export cable corridor	WTG Option A	WTG Option B		Questions to demonstrate assessment has considered all scenarios	Response
	Interconnector and IAC Length (km)	127.4 - 147.6	119.4 - 138.6	Electricity creates electromagnetic fields, consisting of electrical fields, magnetic fields and induced electrical fields. Standard cables include shielding to prevent the passage of electrical fields, however, magnetic fields will pass from the cable, and as they move through the medium of seawater, these can become induced magnetic fields, which have the potential to impact fish and shellfish during the operational phase of the windfarm. Offshore, WTG Option A forms the representative scenario as this represents the greatest length of cable, and therefore Option A forms the presentational basis of the assessment for Impact 8 in this chapter. Option B would result in a lower cable length and would not introduce new impacts, or an impact of different magnitude. The total maximum length of cable during the operational phase is calculated to be 293.6 km.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* 6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).	1. No, WTG Option B would not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, the two layouts are unlikely to have differing magnitudes for Impact 2 as the difference between cable lengths between the two options is minimal. 3. No, infrastructure layout will not influence the sensitivity of the receptor that is being assessed. 4. No, in relation to Impact 2, there is no alternative method. 5. No, in relation to Impact 2, there is no alternative method. 6. No, the method proposed will not influence the sensitivity of the receptor that is being assessed.
	Interconnector and IAC minimum depth of cover (m)	1.0	1.0			
	Interconnector and IAC voltage (kV)	66				
	OECC Length (km)	126 - 146				
	OECC minimum depth of cover (m)	1.4				
	OECC voltage (kV)	220				
	Total length of cables with the potential to emit EMF	253.4 – 293.6	245.4 – 284.6			
Impact 3: Operational Noise		Peak Vessel Numbers	Annual Round Trips	Disturbance from operational noise and vibration relates to maintenance of the infrastructure. This includes vessels to perform the operations, survey equipment to monitor the infrastructures and	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.*	n/a - No variation between scenarios / methods for vessel/survey noise. **For turbine noise:** 1. No, WTG Option B would not introduce any new impact receptor pathways that
	JUVs	2	3			
	Service Operation Vessel (SOV)	1	26			
	CTVs	6	1152			

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
	Cable maintenance vessel	2	1	sound generated by the turbine itself.	*2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	have not already been considered as part of the assessment. 2. No, the two layouts are unlikely to have differing magnitudes for Impact 3 as the difference between cable lengths between the two options is minimal. 3. No, infrastructure layout will not influence the sensitivity of the receptor that is being assessed. 4. No, in relation to Impact 3, there is no alternative method. 5. No, in relation to Impact 3, there is no alternative method. 6. No, the method proposed will not influence the sensitivity of the receptor that is being assessed
	Auxiliary vessel[1]	3	27			
	Array Site and OECC Cable Lay Geophysical Survey Noise • MBES • SBI • SBP – pinger • UHRS – sparker • USBL system • Magnetometer					
	Turbine noise (turbine quantity)	**75**	**60**			
Impact 4: Temporary disturbance of the seabed including associated increases in SSC and deposition	See impact 3 for vessels that may cause disturbance, and impact 1 for areas that may be disturbed.			The temporary disturbance relates to the increase in suspended sediments and the associated deposition that arises from the maintenance of the infrastructure. Offshore, WTG Option A forms the representative scenario as this represents the greatest length of cable and quantity of infrastructure, and therefore Option A forms the presentational basis of the assessment for Impact 4 in this chapter. Option B would result in a lower cable length and would not introduce new impacts, or an impact of different magnitude.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?*	1. No, there are no alternate infrastructure layouts that would introduce new impacts. 2. There is no other layout option that may introduce a larger magnitude of impact. 3. No, sensitivity of the receptor is not altered by changes in layout option. 4. No, changes in maintenance method is unlikely to introduce any new impact receptor pathways that have not already been considered as part of the assessment. 5. No, changes in maintenance method is unlikely to lead to a materially different magnitude of impact. 6. No, the variation in methods proposed will not influence the sensitivity of the receptor that is being assessed.

[1] Includes survey vessels, ROV's, AUVs, Tug operations, cargo vessels, passenger vessels, and scour replacement vessels

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
					6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).	
Impact 5: Collision with vessels	See impact 3 for vessel requirements			No variation between scenarios provided.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser*).	n/a - No variation between scenarios / methods
Impact 6: Accidental pollution events	See impact 4 for contaminant list and impact 6 for vessel requirements			The requirement for use of vessels during operation and maintenance will be the same regardless of the WTG option selected. Therefore, there is only one scenario for this potential impact and this represents the representative Scenario.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?*	n/a - No variation between scenarios / methods

Impact	Relevant project details			Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
					5. Are there alternative installation methods which may introduce a materially different magnitude of impact? *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	
Impact 7: INNS	**See impact 6 for vessel requirements**			The requirement for use of vessels during operation and maintenance will be the same regardless of the WTG option selected. Therefore, there is only one scenario for this potential impact and this represents the representative Scenario.	*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.* *2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?* *5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	n/a - No variation between scenarios / methods

Table 3 Representative scenario assessment - Decommissioning phase impacts

Impact	Relevant project details	Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
Impact 1: Long term habitat loss	It is recognised that legislation and industry best practice change over time. However, for the purposes of the EIA, at the end of the operational lifetime of the CWP Project, all offshore infrastructure will be rehabilitated. In this regard, for the purposes of a representative scenario for decommissioning impacts, the following assumptions have been made:		*1. Are there infrastructure layout options (permanent or temporary) which may introduce new impacts?* *Note - this could be a new impact entirely or the introduction of an existing impact pathway to a new receptor.*	It is not anticipated that there will be differing options for installed infrastructure nor removal methods.

Impact	Relevant project details	Representative scenario(s) and notes / assumptions	Rationale for representative scenario(s)	
Impact 2: Noise and vibration **Impact 3:** Temporary disturbance of the seabed including associated increases in SSC and deposition	• The WTGs and OSS topsides shall be completely removed; • Following WTG and OSS topside decommissioning and removal, the monopile foundations will be cut below the seabed level, to a depth that will ensure the remaining foundation is unlikely to become exposed. This is likely to be approximately one metre below seabed, although the exact depth will depend upon the sea-bed conditions and site characteristics at the time of decommissioning; and • All cables and associated cable protection in the offshore environment shall be wholly removed. It is likely that equipment similar to that which is used to install the cables may be used to reverse the burial process and expose them. Therefore, the area of seabed impacted during the removal of the cables is anticipated to be the same as the area impacted during the installation of the cables.		*2. Are there infrastructure layout options (permanent or temporary) which may introduce a materially different magnitude of impact?* *3. Are there infrastructure layout options (permanent or temporary) which may introduce a material change in the sensitivity of the receptor(s) (greater or lesser)?* *4. Are there alternative installation methods which may introduce new impacts?*	Given the above it is anticipated that for the purposes of a representative scenario, the impacts will be no greater than those identified for the construction phase.
Impact 4: Collision with vessels **Impact 5:** Accidental pollution events **Impact 6:** INNS	It is recognised that legislation and industry best practice change over time. However, for the purposes of the EIA, at the end of the operational lifetime of the CWP Project, all offshore infrastructure will be rehabilitated. In this regard, for the purposes of a representative scenario for decommissioning impacts, the following assumptions have been made: • Generally, decommissioning is anticipated to be a reverse of the construction and installation process for the CWP Project and the assumptions around the number of vessels on site, and vessel round trips is therefore the same as described for the construction phase of the offshore components.		*5. Are there alternative installation methods which may introduce a materially different magnitude of impact?* *6. Are there alternative installation methods which may materially alter the sensitivity of the relevant receptor(s) (greater or lesser).*	For the purposes of the EIA, at the end of the operational lifetime of the CWP Project, all offshore infrastructure will be rehabilitated and there will be no differing options for removal in terms of number of vessels required. Given the above it is anticipated that for the purposes of a representative scenario, the impacts will be no greater than those identified for the construction phase.

4 Limit of Deviation Assessment

14. As described in **Section 2** of this document, locational flexibility of permanent and temporary infrastructure is described as a Limit of Deviation (LoD) from a specific point or alignment.

15. The project components for which a LoD has been defined are presented in **Table 4**. These are further described in EIAR Chapter 4 Project Description and have been presented on the planning drawings that accompany the planning application.

Table 4 Defined limits of deviation

Project component	LoD
Offshore project components	
WTGs	100 m from the centre point of each WTG location
WTG monopile locations	Same as WTGs.
WTG monopile scour protection	Same as WTGs.
OSSs	100 m from the centre point of each OSS location
OSS monopile locations	Same as OSSs.
OSS monopile scour protection	Same as OSSs.
IACs and interconnector cables	100 m either side of the preferred alignment of each IAC and interconnector cable 200 m from the centre point of each WTG location
Offshore export cables	250 m either side of the preferred alignment. The offshore export cable corridor (OECC) outside of the array site.
Landfall	
TJBs	0.5 m either side (i.e. east / west) of the preferred TJB location.
Landfall cable ducts (and associated offshore export cables within the ducts)	Defined LoD boundary with 30 – 55 m horizontal width.
Intertidal cable ducts (and associated offshore export cables within the ducts)	The OECC
Intertidal offshore export cables (non ducted sections)	The OECC
Onshore substation	
Location of onshore substation revetment perimeter structure	Defined LoD boundary

16. For the purposes of the EIAR, the main chapter for fish, shellfish and turtle ecology assesses the specific preferred location for permanent infrastructure. However, this document provides further analysis to determine if the proposed LoD for permanent infrastructure may give rise to any new or materially different effects, taking into consideration the potential impact of the proposed LoD on the magnitude of the impact.

17. For fish, shellfish and turtle ecology this analysis for construction and O&M phase impacts is presented in **Table 2** and **Table 5**, respectively. Where the potential for a LoD to cause a new or materially different effect is identified, then this is noted in the tables below and is considered in full within the main chapter.

Table 5 Limit of deviation assessment - Construction phase impacts

Impact	Relevant project element	Limit of deviation	Questions to demonstrate assessment has considered all scenarios	Response
Impact 1: Temporary seabed habitat disturbance	Generating station		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, temporary habitat disturbance during pre-installation activities has been calculated based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.
	IACs and interconnector cables	100 m either side of the preferred alignment of each IAC and interconnector cable. 200 m from the centre point of each WTG location.		
	WTGs Including monopile and scour protection	100 m from the centre point of each WTG location.		
	OSSs including monopile and scour protection	100 m from the centre point of each OSS location.		
	Offshore export cables			
	Offshore export cables	250 m either side of the preferred alignment within the array site The offshore export cable corridor (OECC) outside of the array site.		
	Landfall			
	TJBs	0.5 m either side (i.e. east / west) of the preferred TJB location.		
	Landfall cable ducts (and associated offshore export cables within the ducts)	Defined LoD boundary with 30 – 55 m horizontal width.		
	Intertidal cable ducts (and associated offshore export cables within the ducts)	The OECC		
	Intertidal offshore export cables (non ducted sections)	The OECC		
Impact 2: Noise and vibration	Generating station		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, noise and vibration related disturbance during installation activities has been calculated based on the upper limit for WTG installation, which factors in the proposed LoD for these project elements. Implementation of the LoD does not therefore alter the assigned magnitude of the impact.
	WTG including monopile and scour protection	100 m from the centre point of each WTG location.		
	OSS including monopile and scour protection	100 m from the centre point of each OSS location.		
	Onshore substation			
	Location of onshore substation revetment perimeter structure	Defined LoD		
	Generating station			

Impact 3: Temporary disturbance of the seabed leading to increases in SSC and associated deposition.	IACs and interconnector cables (including cable protection)	100 m either side of the preferred alignment of each IAC and interconnector cable. 200m from the centre point of each WTG location.	*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, suspended sediments during pre-installation activities has been calculated based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.
	Offshore export cables			
	Offshore export cables (including cable protection)	250 m either side of the preferred alignment within the array site. The offshore export cable corridor (OECC) outside of the array site.		

Table 6 Limit of deviation assessment - Operational phase impacts

Impact	Relevant project element	Limit of deviation	Questions to demonstrate assessment has considered all scenarios	Response
Impact 1: Long term habitat loss	See Construction impact 1		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, habitat disturbance and long-term loss during operation activities has been calculated based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements. The LoD for the WTGs, OSS, and onshore substation revetment does not introduce a materially different magnitude of impact.
Impact 2: EMF from Cables	See Construction impact 1		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, EMF during operation activities has been calculated based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.
Impact 3: Operational Noise	See Construction impact 1		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, noise during operation activities has been based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.
Impact 4: Temporary disturbance of the seabed including associated increases in SSC and deposition	See Construction impact 1		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, temporary disturbance during operation activities has been based on the upper limit for IAC, interconnector and export cable

Impact	Relevant project element	Limit of deviation	Questions to demonstrate assessment has considered all scenarios	Response
			2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?	lengths which factors in the proposed LoD for these project elements.

Table 7 Limit of deviation assessment – Decommissioning phase impacts

Impact	Relevant project element	Limit of deviation	Questions to demonstrate assessment has considered all scenarios	Response
Impact 1: Long term habitat loss	See Construction impact 1		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, long term habitat loss during decommissioning activities has been based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.
Impact 2: Noise and vibration	See Construction impact 2		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, noise and vibration during decommissioning activities has been based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.
Impact 3: Temporary disturbance of the seabed leading to increases in SSC and associated deposition.	See Construction impact 3		*1. Does the proposed LoD (locational flexibility) introduce new impacts? (i.e. the introduction of an existing impact pathway to a new receptor).* *2. Does the proposed LoD (locational flexibility) introduce a materially different magnitude of impact?*	1. No, the implementation of the LoD does not introduce any new impact receptor pathways that have not already been considered as part of the assessment. 2. No, temporary increase in suspended sediments during decommissioning activities has been based on the upper limit for IAC, interconnector and export cable lengths which factors in the proposed LoD for these project elements.