GREEN VOLT

Chapter 21
Summary

Offshore EIA Report: Volume 1

Revision history

Revision	Date	Description	Prepared	Checked	Approved
1	06/01/2023	First draft	HF (Royal HaskoningDHV)	CM (Royal HaskoningDHV)	VC (Flotation Energy)
2	09/01/2023	Second draft	HF (Royal HaskoningDHV)	CM (Royal HaskoningDHV)	VC (Flotation Energy)
3	09/01/2023	Final for submission	HF (Royal HaskoningDHV)	CM (Royal HaskoningDHV)	VC (Flotation Energy)

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Acronyms

Acronym	Description
AAP	Areas of Archaeological Potential
AEZ	Archaeological Exclusion Zones
AIS	Automatic Identification System
ADD	Acoustic Deterrent Device
BEIS	Department for Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
CaP	Cable Plan
CEMP	Construction Environmental Management Plan
COLREGS	International Regulations for Preventing Collisions at Sea 1972
DECC	Department for Energy and Climate Change
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
GHG	Greenhouse gas
GPS	Global Positioning System
GVA	Gross Value Added
HDD	Horizontal Directional Drilling

INTOG	Innovation and Targeted Oil and Gas (INTOG) Decarbonisation
JNCC	Joint Nature Conservation Committee
LMP	Lighting and Marking Plan
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MINNS	Marine Invasive Non-Native Species
MMMP	Marine Mammal Mitigation Protocol
MoD	Ministry of Defence
MPA	Marine Protected Area
MS-LOT	Marine Scotland Licensing Operations Team
NLB	Northern Lighthouse Board
NOTAM	Notice to Air Missions
NtM	Notice to Mariners
OSP	Offshore Substation Platform
PEMP	Project Environmental Monitoring Plan
PMF	Priority Marine Feature

PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SAR	Search and Rescue
SCDS	Supply Chain Development Strategy
SOLAS	The International Convention for the Safety of Life at Sea
TAEZ	Temporary Archaeological Exclusion Zone
TPV	Third Party Verification
TTS	Temporary Threshold Shift
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance
VMP	Vessel Management Plan
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator

Glossary

Term	Description
Applicant	Green Volt Offshore Windfarm Ltd.
Buzzard	Buzzard Platform Complex.
Buzzard Export Cable Corridor	The area in which the export cables will be laid, from the perimeter of the Windfarm Site to Buzzard Platform Complex.
Green Volt Offshore Windfarm	Offshore windfarm including associated onshore and offshore infrastructure development (Combined On and Offshore Green Volt Projects).
Horizontal Directional Drilling	Mechanism for installation of export cable at landfall.
Inter-array cables	Cables which link the wind turbines to each other and the offshore substation platform.
Landfall Export Cable Corridor	The area in which the export cables will be laid, from the perimeter of the Windfarm Site to landfall.
Mean High Water Springs	At its highest and 'Neaps' or 'Neap tides' when the tidal range is at its lowest. The height of Mean High Water Springs (MHWS) is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest (Spring tides).
Moorings	Mechanism by which wind turbine generators are fixed to the seabed.
NorthConnect Parallel Export Cable Corridor Option	Landfall Export Cable Corridor between NorthConnect Parallel Landfall and point of separation from St Fergus South Export Cable Corridor Option.
NorthConnect Parallel Landfall	Southern landfall option where the offshore export cables come ashore.
Offshore Development Area	Encompasses i) Windfarm Site, including offshore substation platform ii) Offshore Export Cable Corridor to Landfall, iii) Export Cable Corridor to Buzzard Platform Complex.
Offshore export cables	The cables which would bring electricity from the offshore substation platform to the Landfall or to the Buzzard Platform Complex.
Offshore Export Cable Corridor	The proposed offshore area in which the export cables will be laid, from offshore substation to landfall or to the Buzzard Platform Complex.
Offshore infrastructure	All of the offshore infrastructure, including wind turbine generators, offshore substation platform and all inter-array and export cables.
Offshore substation platform	A fixed structure located within the Windfarm Site, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Onshore Export Cable Corridor	The proposed onshore area in which the export cables will be laid, from landfall to the onshore substation.

Project	Green Volt Offshore Windfarm project as a whole, including associated onshore and offshore infrastructure development.
Safety zones	An area around a structure or vessel which must be avoided.
St Fergus South Export Cable Corridor Option	Landfall Export Cable Corridor between St Fergus South Landfall and point of separation from NorthConnect Parallel Export Cable Corridor Option.
St Fergus South Landfall	Northern landfall option where the offshore export cables come ashore.
Windfarm Site	The area within which the wind turbine generators, offshore substation platform and inter-array cables will be present.

CHAPTER 21: OFFSHORE EIA REPORT SUMMARY

21.1 Introduction

1. This Chapter of the **Offshore Environmental Impact Report (EIA) Report** provides a summary of the potential offshore environmental impacts from the Project (in this instance the Project refers to the offshore elements of the Green Volt Offshore Windfarm only, up to Mean High Water Springs (MHWS)), as identified in **Chapters 7 – 19** of this **Offshore EIA Report**.

2. The potential impacts of the Project were first identified and then assessed, taking into consideration the:

   - Receptor value and sensitivity, by accounting for adaptability, tolerance recoverability and value (economic value, rarity, local or regional importance); and
   - Magnitude of the impact, in terms of extent, duration, likelihood, frequency and nature of change.

3. The significance of potential effects has been defined by considering receptor sensitivity in combination with the magnitude of a given impact, also taking into consideration embedded mitigation measures. Embedded mitigation measures have been built into the design of the Project have been included for consideration in the impact assessment. The embedded mitigation measures for each topic are provided in **Section 21.2** below.

4. To determine the significance of effect, a matrix was used, as provided in **Table 6.1** of **Chapter 6: EIA Methodology**. Each effect is graded on a scale from 'negligible' to 'major', either adverse or beneficial. For the purposes of this EIA, major and moderate adverse effects are deemed to be significant, and, as such, may require additional mitigation. **Section 21.2** sets out any additional mitigation measures that have been proposed to reduce any significant effects to acceptable levels. Effects rated as minor or negligible adverse are not considered significant in EIA terms. Where there are variations to this approach, these are detailed within the relevant chapters.

5. This summary also provides a summary of impacts (**Section 21.4**) assessed for the Southern Trench Marine Protected Area (MPA) to inform the MPA assessment to be undertaken by the Public Authority.

21.2 EIA Outcomes

6. **Sections 7** to **21.3.13** summarise the outcomes of the impact assessment for each technical chapter in the **Offshore EIA Report,** and details embedded mitigation measures.

7. The outcome of the EIA, which is based on a realistic worst case scenario, shows that the Project is anticipated to result in only one significant adverse effect – a moderate adverse effect on grey seal (*Halichoerus grypus*) due to cumulative disturbance from underwater noise during piling and construction for the Project. This is deemed to be a precautionary and conservative assessment, based on the worst case scenarios for all potential offshore wind farms that could be piling or constructing at the same time as the Project. While there is a moderate effect significance for grey seal, the Project is contributing a relatively small amount to the overall cumulative underwater noise disturbance. For grey seal, the effect significance is moderate adverse with and without underwater noise during piling and construction at the Project. Therefore, no additional mitigation measures are proposed for the Project.

8. The **Offshore EIA Report** also identified significant beneficial effects for:

   - Socioeconomics, tourism and recreation, where major and moderate beneficial effects were identified for direct employment and supply chain impacts during the construction phase; and
   - Climate, with respect to a major beneficial impact to greenhouse gas (GHG) emissions during construction, operation and decommissioning, in comparison to the without-project baseline and net zero aspirations.

21.3 Commitments Register

9. A commitments register is presented in **Appendix 21.1** of this **Offshore EIA Report** and details the mitigation measures which Green Volt Offshore Windfarm Ltd (the Applicant) have committed to. These measures will avoid, minimise and reduce potential adverse environmental impacts during design, construction, operation and maintenance and decommissioning of the offshore elements of the Project. **Appendix 21.1** also specifies the consent plan and / or mechanism through which each commitment will be secured.

21.3.1 Marine Geology Oceanography and Physical Processes

Embedded Mitigation

10. Horizontal directional drilling (HDD) will be used to connect the Landfall Export Cable to shore to avoid disturbance to the cliffs (NorthConnect Parallel Landfall option) or dunes (St. Fergus South Landfall option), intertidal shore and nearshore seabed that would otherwise be caused by trenching (or similar intrusive installation).

11. The Offshore Export Cable Corridors have been refined during the EIA process so that the design envelope of each corridor option has been narrowed as far as practicable towards each landfall. In particular, the St. Fergus South Landfall option no longer covers the bay of St. Fergus, but is narrowed to an area further south (just north of Peterhead).

Summary of Impacts

Table 21.1 Summary of Potential Impacts Identified for Marine Geology, Oceanography and Physical Processes

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1: Damage to seabed structure and form	Seabed (seaward of HDD option exit point to 12 nm limit)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
C2: Increase in suspended sediment concentration and deposition	Seabed (seaward of HDD option exit point to 12 nm limit)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
C3 - Disturbance of seabed sediments during cable installation	Seabed	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
Operation & Maintenance						
O1: Rock deposit or concrete mattress footprint on seabed	Seabed (seaward HDD exit point to 12 nm limit)	Negligible	Low	Negligible adverse	None required	Negligible adverse – not significant
O2: Effect of rock deposits or concrete mattresses on wave, tidal and sediment regime	Seabed (seaward of HDD option exit point to 12 nm limit)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
O3: Disturbance of seabed sediments due to catenary action of mooring lines in Windfarm Site	Seabed (Windfarm Site)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
O4: Disturbance of seabed sediments due to scour around the foundations of the mooring anchors in Windfarm Site	Seabed (Windfarm Site)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
O5: Changes to water column mixing by the presence of	Water column	No impact				

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
structures and/or alterations to the near-surface wind speeds in Windfarm Site						
Decommissioning						
D1: Damage to seabed structure and form	Seabed (seaward of HDD option exit point to 12 nm limit)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
D2: Increase in suspended sediment concentration and deposition	Seabed (seaward of HDD option exit point to 12 nm limit)	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
D3 : Disturbance of seabed sediments (suspension and deposition) during cable removal	Seabed	Negligible	Negligible	Negligible adverse	None required	Negligible adverse – not significant
Cumulative						
None identified						
Transboundary						
None identified						

21.3.2 Marine Sediment and Water Quality

Embedded Mitigation

12. A summary of the embedded mitigation accounted for in the impact assessment for marine sediment and water quality is provided below. Full details are given in **Section 8.7.1** in **Chapter 8: Marine Sediment and Water Quality**.

13. All Project vessels will follow the requirements set out in International Convention for the Prevention of Pollution from Ships (MARPOL).

14. Drill mud discharge will be kept to a minimum and will be water-based, rather than oil-based, with minimum drilling lubricants used during the final exit phase onto the seabed.

15. HDD will be used to connect the Landfall Export Cable to shore to avoid disturbance to the cliffs. This also results in no potential resuspension of sediments within the intertidal and near shore area.

16. Prior to the last one to two metres of HDD drill out before punch out, the borehole will be flushed with water to minimise the risk of bentonite slurry entering the marine system.

17. Localised dredge disposal sites for the Port of Peterhead have been avoided in all export cable routing options.

18. The locations of the anchors and offshore substation platform (OSP) foundations will be determined in advance using survey information, therefore the location of each anchor will be chosen to avoid the need for seabed preparation (i.e. avoiding pock marks or straddling through micrositing, see **Chapter 5: Project Description**).

19. Provision will be made to allow ongoing monitoring for potential for hazards to other users of the sea and to ensure there is recovery of the environment after decommissioning of oil and gas assets. The wind turbine generator (WTG) array pattern and position applied will deliberately avoid placing turbines and substructures directly above pipelines and umbilicals remaining in-situ, and abandoned well-centres at the seabed. The final offsets applied will be determined by collaboration with the oil and gas operator via a structured risk assessment approach. Positioning of wind farm equipment on the seabed such as moorings and inter-array cables will also avoid interaction where possible, however, there is a strong likelihood that crossings will be necessary. Such crossings will be finalised with the input and agreement with the oil and gas operator since they will be legally responsible for the notification process and the ongoing liability associated with the decommissioned equipment affected by the crossing.

20. A Construction Environmental Management Plan (CEMP) to be drafted and adhered to.

21. Transition pits sited to avoid Marine Protected Areas (MPAs).

Summary of Impacts

Table 21.2 Potential Impacts Identified for Marine Sediment and Water Quality

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1 - Increase in suspended sediment concentrations created by installation of turbine substructures, inter-array cables and OSP foundations	Water and Sediment Quality	Low	Low	Minor adverse	None required	Minor adverse – not significant
C2 - Increase in suspended sediment concentration associated with export cable installation	Water and Sediment Quality	Low	Low	Minor adverse	None required	Minor adverse - not significant
C3 - Increase in suspended solids concentrations due to works at landfall	Water and Sediment Quality	Low	Negligible	Negligible adverse	None required	Negligible adverse - not significant
C4 - Deterioration in water quality due to re-suspension of sediment bound contaminants offshore	Water and Sediment Quality	Low	Negligible	Negligible adverse	None required	Negligible adverse - not significant
C5 - Deterioration in water quality due to re-suspension of sediment bound contaminants along the export cable corridor	Water and Sediment Quality	Low	Negligible	Negligible adverse	None required	Negligible adverse - not significant
Operation & Maintenance						
O1 - Increase in suspended sediment concentrations due to mooring lines and erosion/ scour offshore	Water and Sediment Quality	Low	Low	Minor adverse	None required	Minor adverse - not significant
O2 - Alteration of water column mixing associated from physical presence of wind farm structures and changes to surface wind speeds	No impact					
O3 - Increase in suspended sediment concentrations due to cable repairs/reburial	Water and Sediment Quality	Low	Negligible	Negligible adverse	None required	Negligible adverse - not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Decommissioning						
D1 - Increase in suspended sediment due to decommissioning activities	Water and Sediment Quality	Low	Low	Minor adverse	None required	Minor adverse - not significant
D2 - Deterioration in water quality due to the release of contaminants during decommissioning activities	Water and Sediment Quality	Low	Negligible	Negligible adverse	None required	Negligible adverse - not significant
Cumulative						
None identified						
Transboundary						
None identified						

21.3.3 Benthic Ecology

Embedded Mitigation

22. A summary of the embedded mitigation accounted for in the impact assessment for benthic ecology is provided below. Full details are given in **Section 9.7.1** in **Chapter 9: Benthic Ecology**.

23. Infrastructure will not be situated in pockmarks (where there is the potential for submarine structures from leaking gases due to the risk of shallow gas.

24. '*S. spinulosa* and *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' priority marine features (PMF) are recorded during surveys along the Landfall Export Cable Corridor, and cable routing will be microsited to avoid impacts on these features.

25. A Cable Plan (CaP) will be developed to set out the installation programme, methods, cable technical specifications, cable burial risk assessment, and management measures for electromagnetic field (EMF) attenuation, for both the export cables and inter-array cables. It will also include any mitigation measures for environmental and navigational issues. The avoidance of sensitive benthic habitats/species and species/habitats of conservation importance will be a key consideration in the detailed design of the final cable routes.

26. Cables will be buried, where possible, for both the inter-array and Offshore Export Cables. This strategy aims to reduce the need for additional cable protection, and therefore as the amount of hard substrate required. Should any sections of the marine cable require additional protection following combined lay/burial operation, then this will be provided by post lay jet burial (if possible), engineered, localised rock placement or concrete mattressing. Sections of cable may also be fitted with additional cast iron or synthetic external cladding to provide localised protection in certain areas. Cable protection will be monitored as per cable suppliers' recommendations, and in agreement with power purchase customers.

27. A separate CEMP will be developed prior to construction.

28. A Marine Pollution Contingency Plan in the CEMP will set out the management measures to be implemented during construction, operation and decommissioning to mitigate the risks of accidental spills of hazardous materials, measures to prevent spills, as well as remedial actions and response measures to be used in the event of a spill or collision. It will also detail measures for refuelling at sea.

29. The WTG array pattern and position applied will deliberately avoid placing turbines and substructures directly above pipelines and umbilicals remaining in-situ, and abandoned well-centres at the seabed. The final offsets applied will be determined by collaboration with the oil and gas operator via a structured risk assessment approach. Positioning of wind farm equipment on the seabed such as moorings and inter-array cables will also avoid interaction where possible, however, there is a strong likelihood that crossings will be necessary. Such crossings will be finalised with the input and agreement with the oil and gas operator since they will be legally responsible for the notification process and the ongoing liability associated with the decommissioned equipment affected by the crossing.

Monitoring

30. Biosecurity plans will be in place including adhering to best practice guidelines for activities such as bilge pumping and use of antifouling. Training on marine invasive non-native species (MINNS) will be provided to contractors conducting operation and maintenance tasks so that common MINNS can be recognised, and steps to take if such species are observed on moorings to prevent further spread. Should MINNS be identified as part of the offshore Project activities, a management and monitoring plan will be developed to measure the impact of any steps taken to prevent further spread and to reduce MINNS presence.

Summary of Impacts

Table 21.3 Summary of Potential Impacts to Benthic Ecology

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1: Physical disturbance and temporary habitat loss of seabed habitat	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
C2: Physical disturbance and temporary loss of seabed habitat in the Southern Trench MPA	Burrowed mud and habitat suitable for Nephrops	Medium	Negligible	Minor adverse	None required	Minor adverse – not significant
C3: Increased suspended sediments and sediment re-deposition	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Low	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
C4: Re-mobilisation of contaminated sediment during intrusive works	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
C5: Potential introduction of marine invasive non-native species (MINNS).	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
Operation & Maintenance						
O1: Permanent habitat loss and introduction of hard substrate	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
O2: Impacts of scour on benthic communities arising from the mooring chains and anchors	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	N. norvegicus					
	Sabellaria spinulosa					
O3: Electromagnetic Fields (EMF).	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Low	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
O4 Potential introduction of MINNS	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
Decommissioning						
D1: Physical Disturbance and Temporary Habitat Loss of Seabed Habitat from Removal of Hard Substrate	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
D2: Potential impacts on the Southern Trench MPA	Burrowed mud and habitat suitable for Nephrops	Negligible	Low	Minor adverse	None required	Minor adverse – not significant
D3: Increased suspended sediments and sediment re-deposition	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
D4: Re-mobilisation of contaminated sediment during intrusive works	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
D5: Potential introduction of MINNS	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
Cumulative						
CIA – C5: Potential introduction of MINNS	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
CIA - O3: EMF	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Low	Low	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Abra prismatica in Circalittoral Fine Sand					
CIA - O4: Potential introduction of MINNS	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
CIA – D5: Potential introduction of MINNS	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor adverse	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
Transboundary						
None identified						

21.3.4 Fish and Shellfish Ecology

Embedded Mitigation

31. A summary of the embedded mitigation accounted for in the impact assessment for fish and shellfish ecology is provided below. Full details are given in **Section 10.7.1** in **Chapter 10: Fish and Shellfish Ecology**.

32. Through completion of site-specific surveys and review of previous survey data, site selection of the Windfarm Site and Landfall Export Cable Corridor has been undertaken to avoid key commercial fisheries and protected fish species and habitats (e.g. PMFs, spawning areas and sites designated for fish and shellfish interests such as rivers designated as Special Areas of Conservation (SACs) for diadromous fish) as far as possible.

33. Cables, wherever possible, will be buried to a target depth of 0.6-1.5m in accordance with Department of Energy and Climate Change (DECC) Guidelines (2011) and other guidance as appropriate which will reduce the potential for impacts relating to EMF.

34. Cables will be specified to reduce EMF emissions as per industry standards and best practice such as the relevant International Electrotechnical Commission specifications.

35. To minimise the extent of any unnecessary habitat disturbance, material displaced as a result of cable burial activities will be back filled, if required, in order to ensure sufficient cable burial is achieved. Cable protection will be monitored as per cable suppliers' recommendations, and in agreement with power purchase customers.

36. A Piling Strategy for the single OSP will be submitted to Marine Scotland Licensing Operations Team (MS-LOT) for approval prior to the commencement of piling outlining any mitigation and management measures that will be implemented during pile installation.

37. During piling for the single OSP, standard operations for installing monopiles will be followed, i.e. soft starts will be used, with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels. This measure will reduce the risk of injury to mobile sound-sensitive fish species in the immediate vicinity of piling operations. The use of acoustic deterrent devices (ADD) will be discussed with the relevant stakeholders and will be implemented through the Marine Mammal Mitigation Plan (MMMP).

Monitoring

38. As discussed in **Section 10.3.1** of **Chapter 10: Fish and Shellfish Ecology**, the Applicant anticipates that a Joint Industry Project or a collaborative research programme which supports the development of the technique for the far offshore marine environment would be established. Through cross-industry data sharing, this Project, and others, can begin to address the key knowledge gaps around offshore eDNA dynamics, thereby approaching a position where this technique can be usefully deployed far offshore, both as a baseline characterisation and monitoring tool. Depending on the timescales of any collaborative research programme then the Applicant may be able to contribute, directly or indirectly. For example, during the development of the project environmental monitoring plan (PEMP) consideration can be given to whether there are practical opportunities for eDNA samples to be collected if there are appropriate vessels on site.

Summary of Impacts

Table 21.4 Summary of Potential Impacts Identified for Fish and Shellfish Ecology

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1: Physical disturbance and temporary habitat loss	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Diadromous Fish	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Elasmobranchs	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Pelagic Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	Medium	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Molluscs	High	Negligible/Minor	Minor Adverse	None required	Minor Adverse - Not significant
	Designated Sites	No impact				
C2: Increased suspended sediments and sediment re-deposition	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Diadromous Fish	No impact				
	Elasmobranchs - Demersal	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Elasmobranchs - Pelagic	No impact				
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Pelagic Fish	No impact				
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	High	Negligible	Spiny lobster: Minor Adverse All others: Negligible Adverse	None required	Spiny lobster: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Molluscs	High	Negligible	Ocean quahog: Minor Adverse All others: Negligible	None required	Ocean quahog: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Designated Sites	No impact				
C3: Re-mobilisation of contaminated sediments and sediment redistribution	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Nursery Grounds	No impact				
	Diadromous Fish	No impact				
	Elasmobranchs - Demersal	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Elasmobranchs - Pelagic	No impact				
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Marine Pelagic Fish	No impact				
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	High	Negligible	Spiny lobster: Minor Adverse All others: Negligible	None required	Spiny lobster: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Molluscs	High	Negligible	Ocean quahog: Minor Adverse All others: Negligible	None required	Ocean quahog: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Designated Sites	No impact				
C4: Underwater noise and vibration	Spawning Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Nursery Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Diadromous Fish	Medium	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Elasmobranchs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Marine Demersal Fish	Low and Medium (cod)	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Marine Pelagic Fish	Low and Medium (herring and sprat)	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Molluscs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Designated Sites	No impact				
C5: Commercially exploited species associated with their displacement from the area of activity/works	Spawning Grounds	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Nursery Grounds	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Diadromous Fish	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Elasmobranchs	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Marine Demersal Fish	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Marine Pelagic Fish	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Cephalopods	Low	Negligible Beneficial	Negligible Beneficial	None required	Negligible Beneficial – Not significant
	Crustaceans	High	Negligible Beneficial	Spiny lobster: Minor Beneficial	None required	Spiny lobster: Minor Beneficial – Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
				All others: Negligible Beneficial		All others: Negligible Beneficial – Not significant
	Molluscs	High	Negligible Beneficial	Ocean quahog: Minor Beneficial All others: Negligible Beneficial	None required	Ocean quahog: Minor Beneficial – Not significant All others: Negligible Beneficial – Not significant
	Designated Sites	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
Operation & Maintenance						
O1: Temporary and permanent habitat loss	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse – Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse – Not significant
	Diadromous Fish	Very High	Negligible	Minor Adverse	None required	Minor Adverse – Not significant
	Elasmobranchs	Very High	Negligible	Minor Adverse	None required	Minor Adverse – Not significant
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse – Not significant
	Marine Pelagic Fish	High	Negligible	Minor Adverse	None required	Minor Adverse – Not significant
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Crustaceans	Medium	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Molluscs	High	Negligible/Minor	Minor Adverse	None required	Minor Adverse – Not significant
	Designated Sites	No impact				

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
O2: Re-mobilisation of contaminated sediments and sediment redistribution	Spawning Grounds	High (herring and sandeel)	Negligible (herring and sandeel)	Minor Adverse (herring and sandeel)	None required	Minor Adverse (herring and sandeel) – Not significant
	Nursery Grounds	No impact				
	Diadromous Fish	No impact				
	Elasmobranchs - demersal	No impact				
	Elasmobranchs - pelagic	No impact				
	Marine Demersal Fish	No impact				
	Marine Pelagic Fish	No impact				
	Cephalopods	No impact				
	Crustaceans	No impact				
	Molluscs	No impact				
	Designated Sites	No impact				
O3: Introduction of foundations, scour protection, hard substrate and habitats	Spawning Grounds	No impact				
	Nursery Grounds	No impact				
	Diadromous Fish	No impact				
	Elasmobranchs	No impact				

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Marine Demersal Fish - Rocky seabed preference (e.g. cod, whiting, saithe, ling):	High	Negligible beneficial	Negligible beneficial	None required	Negligible beneficial – Not significant
	Marine Demersal Fish – all others	No impact				
	Marine Pelagic Fish	No impact				
	Cephalopods	Low	Negligible Beneficial	Negligible Beneficial	None required	Negligible Beneficial – Not significant
	Crustaceans	High	Negligible Beneficial	Negligible Beneficial	None required	Negligible Beneficial – Not significant
	Molluscs	No impact				
	Designated Sites	No impact				
O4: Underwater noise and vibration	Spawning Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Nursery Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Diadromous Fish	Medium	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Elasmobranchs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Marine Demersal Fish	Low and Medium (cod)	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Marine Pelagic Fish	Low and Medium	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
		(herring and sprat)				
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Crustaceans	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Molluscs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Designated Sites	No impact				
O5: EMFs	Spawning Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Nursery Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Diadromous Fish	Low	Low	Negligible Adverse	None required	Negligible Adverse – Not significant
	Elasmobranchs	Medium	Low	Minor Adverse	None required	Minor Adverse – Not significant
	Marine Demersal Fish	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Marine Pelagic Fish	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Crustaceans	Low	Low	Negligible Adverse	None required	Negligible Adverse – Not significant
	Molluscs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse – Not significant
	Designated Sites	No impact				

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
O6: Commercially exploited species associated with their displacement from the area of activity/works	Spawning Grounds	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial
	Nursery Grounds	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Diadromous Fish	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Elasmobranchs	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Marine Demersal Fish	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Marine Pelagic Fish	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Cephalopods	Low	Negligible Beneficial	Negligible Beneficial	None required	Negligible Beneficial – Not significant
	Crustaceans	High	Negligible Beneficial	Spiny lobster: Minor Beneficial All others: Negligible Beneficial	None required	Spiny lobster: Minor Beneficial – Not significant All others: Negligible Beneficial – Not significant
	Molluscs	High	Negligible Beneficial	Ocean quahog: Minor Beneficial All others: Negligible Beneficial	None required	Ocean quahog: Minor Beneficial – Not significant All others: Negligible Beneficial – Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Designated Sites	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
Decommissioning						
D1: Physical disturbance and temporary habitat loss	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Diadromous Fish	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Elasmobranchs	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Pelagic Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	Medium	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Molluscs	High	Negligible/Minor	Minor Adverse	None required	Minor Adverse - Not significant
	Designated Sites	No impact				
D2: Increased suspended sediments and sediment re-deposition	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Diadromous Fish	No impact				

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Elasmobranchs - demersal	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Elasmobranchs - pelagic	No impact				
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Pelagic Fish	No impact				
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	High	Negligible	Spiny lobster: Minor Adverse All others: Negligible Adverse	None required	Spiny lobster: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Molluscs	High	Negligible	Ocean quahog: Minor Adverse All others: Negligible	None required	Ocean quahog: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Designated Sites	No impact				
D3: Re-mobilisation of contaminated sediments and sediment	Spawning Grounds	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Nursery Grounds	No impact				
	Diadromous Fish	No impact				
	Elasmobranchs - Demersal	Very High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Elasmobranchs - Pelagic	No impact				
	Marine Demersal Fish	High	Negligible	Minor Adverse	None required	Minor Adverse - Not significant
	Marine Pelagic Fish	No impact				
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	High	Negligible	Spiny lobster: Minor Adverse All others: Negligible	None required	Spiny lobster: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Molluscs	High	Negligible	Ocean quahog: Minor Adverse All others: Negligible	None required	Ocean quahog: Minor Adverse - Not significant All others: Negligible Adverse - Not significant
	Designated Sites	No impact				
D4: Underwater noise and vibration	Spawning Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Nursery Grounds	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Diadromous Fish	Medium	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Elasmobranchs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Marine Demersal Fish	Low and Medium (cod)	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Marine Pelagic Fish	Low and Medium (herring and sprat)	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Cephalopods	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Crustaceans	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Molluscs	Low	Negligible	Negligible Adverse	None required	Negligible Adverse - Not significant
	Designated Sites	No impact				
D5: Commercially exploited species associated with their displacement from the area of activity/works	Spawning Grounds	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Nursery Grounds	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Diadromous Fish	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Elasmobranchs	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Marine Demersal Fish	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
	Marine Pelagic Fish	High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Cephalopods	Low	Negligible Beneficial	Negligible Beneficial	None required	Negligible Beneficial – Not significant
	Crustaceans	High	Negligible Beneficial	Spiny lobster: Minor Beneficial All others: Negligible Beneficial	None required	Spiny lobster: Minor Beneficial – Not significant All others: Negligible Beneficial – Not significant
	Molluscs	High	Negligible Beneficial	Ocean quahog: Minor Beneficial All others: Negligible Beneficial	None required	Ocean quahog: Minor Beneficial – Not significant All others: Negligible Beneficial – Not significant
	Designated Sites	Very High	Negligible Beneficial	Minor Beneficial	None required	Minor Beneficial – Not significant
Cumulative						
None identified						
Transboundary						
None identified						

21.3.5 Marine Mammal Ecology

Embedded Mitigation

39. A summary of the embedded mitigation accounted for in the impact assessment for marine mammal ecology is provided below. Full details are given in **Section 11.7.1** in **Chapter 11: Marine Mammal Ecology**.

40. Soft-start and ramp-up (part of Marine Mammal Mitigation Protocol; MMMP) for Piling Activities for the single OSP.

- Each piling event would commence with a soft-start at a lower hammer energy followed, by a gradual ramp-up for at least 20 minutes to the maximum hammer energy required.
- The MMMP for piling for the single OSP installation will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design. The MMMP will include details of the mitigation zone and any additional mitigation measures required in order to minimise potential impacts of any physical injury or permanent threshold shift (PTS), for example, the activation of ADD prior to the soft-start.

41. The Piling Strategy for the single OSP installation will be submitted to MS-LOT for approval prior to the commencement of piling, outlining mitigation and management measures that will be implemented during pile installation.

42. The MMMP for unexploded ordnance (UXO) clearance will ensure there are adequate mitigation measures to minimise the risk of any physical or permanent auditory injury to marine mammals as a result of UXO clearance. This would consider the options, suitability and effectiveness of mitigation measures such as, but not limited to:

- Low-order clearance techniques, such as deflagration
- The use of bubble curtains if any high-order detonation is required (taking into consideration the environmental limitations)
- Monitoring requirements for marine mammal observers
- Requirements for ADD
- Other UXO clearance techniques, such as avoidance of UXO; or relocation of UXO. If more than one high-order detonation is required, other measures such as the use of scare charges; or multiple detonations, if UXO are located in close proximity, will also be considered.

43. Best practice to reduce vessel collision risk.

- Vessel movements, where possible, will follow set vessel routes and hence areas where marine mammals are accustomed to vessels, in order to reduce any increased collision risk. All vessel movements will be kept to the minimum number that is required to reduce any potential collision risk. Additionally, vessel operators will use good practice to reduce any risk of collisions with marine mammals.
- The Scottish Marine Wildlife Watching Code (Scottish Natural Heritage, 2017) will be followed, to reduce the potential for a vessel collision, by reducing vessel transit speeds and by maintaining speed and course when in the presence of marine mammal species.

44. Reduce potential impact of EMF.

- Cables, wherever possible, will be buried to a target depth of 0.6-1.5m in accordance with DECC Guidelines (2011) and other guidance as appropriate which will reduce the potential for impacts relating to EMF.

- Cables will be specified to reduce EMF emissions as per industry standards and best practice such as the relevant International Electrotechnical Commission specifications.

45. Marine Pollution Contingency Plan in the CEMP will set out the management measures to be implemented during construction, operation and decommissioning to mitigate the risks of accidental spills of hazardous materials, measures to reduce instances of spills, remedial action and response measures to be used in the event of a spill or collision, and detail measures for refuelling at sea.

46. If required, mitigation for geophysical surveys (particularly if using Sub-bottom profilers, Sparkers and Ultra-Short Baseline system) will follow the Joint Nature Conservation Committee (JNCC) (2017) '*Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys*'.

Monitoring

47. The PEMP will include for monitoring for entanglement risk and will be agreed with Marine Scotland and NatureScot prior to construction. This will include:

- Monitoring for large strains on mooring lines, designed to alert if there is unexpected load which can then be examined.
- Surveys: the turbines and mooring systems would be regular checked by remotely operated vehicle.

48. The monitoring measures will be developed to reduce the potential for an entanglement event to occur. Any entanglement event that does occur through the lifetime of the project will be reported, and full information of the incident will be recorded.

49. In the event that any entanglement of a marine mammal does occur during the operation of the Project, additional mitigation and monitoring measures may be required to ensure it does not happen again.

Table 21.5 Summary of Potential Impacts Identified for Marine Mammals

Potential Impact	Receptor	Value / Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1: PTS from underwater noise during geophysical surveys	All marine mammal species	High	Negligible	Minor adverse	Mitigation for geophysical surveys (see **Section 11.7.1.3**).	Minor adverse – not significant
C1: Temporary threshold shift (TTS) and disturbance from underwater noise during geophysical surveys	All marine mammal species	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
C2: PTS from underwater noise during UXO clearance	Harbour porpoise	High	Medium	Major adverse	MMMP for UXO Clearance (see **Section 11.7.1.2**).	Minor adverse – not significant
	Bottlenose dolphin, grey seal	High	Low to Medium	Moderate to Major adverse		Minor adverse – not significant
	White-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin, humpback whale	High	Negligible	Minor adverse		Minor adverse – not significant
	Minke whale	High	Low	Moderate adverse		Minor adverse – not significant
	Harbour seal	High	Low to Negligible	Minor to Moderate adverse		Minor adverse – not significant
C2: PTS from underwater noise during low-order UXO clearance	All marine mammal species	High	Negligible	Minor adverse		Minor adverse – not significant
C2: TTS and disturbance from underwater noise during high-order or low-order UXO clearance	All marine mammal species	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
C2: Disturbance from ADD activation for low-order UXO clearance	All marine mammal species	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
C2: Disturbance from ADD activation for high-order UXO clearance	Bottlenose dolphin	Medium	Low to Negligible	Minor adverse	None required.	Minor adverse – not significant

Potential Impact	Receptor	Value / Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	All other marine mammal species	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
C3: PTS from a single strike pile	All marine mammal species	High	Negligible	Minor adverse	MMMP for piling (see **Section 11.7.1.1**).	Minor adverse – not significant
C3: PTS due to cumulative exposure of the installation of one pile without ADD activation	Harbour porpoise, minke whale, humpback whale	High	Negligible	Minor adverse		Minor adverse – not significant
	All other marine mammal species	No impact				
C3: PTS due to cumulative exposure of the installation of one pile with 15 minutes of ADD activation	All marine mammal species	No impact				
C3: TTS from a single strike of the pile	All marine mammal species	Medium	Negligible	Minor adverse	MMMP for piling (see **Section 11.7.1.1**).	Minor adverse – not significant
C3: TTS due to cumulative exposure of the installation of one pile without ADD activation	Harbour porpoise, humpback whale, grey seal, harbour seal	Medium	Negligible	Minor adverse		Minor adverse – not significant
	Minke whale	Medium	Low	Minor adverse		Minor adverse – not significant
	All dolphin species	No impact				
C3: TTS due to cumulative exposure of the installation of one pile with 15 minutes of ADD activation	Harbour porpoise, minke whale, humpback whale	Medium	Negligible	Minor adverse	MMMP for piling (see **Section 11.7.1.1**).	Minor adverse – not significant
	All other marine mammal species	No impact				
C3: Disturbance from piling	All marine mammal species	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
C4: PTS from underwater noise for other construction activities	All marine mammal species	No impact				
C4: TTS from underwater noise for other construction activities	Harbour porpoise, grey seal, harbour seal	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
	All dolphin and whale species	No impact				

Potential Impact	Receptor	Value / Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
C4: Disturbance from underwater noise for other construction activities	Bottlenose dolphin	Medium	Negligible to Low	Minor adverse	None required.	Minor adverse – not significant
	All other marine mammal species	Medium	Negligible	Minor adverse		Minor adverse – not significant
C5: PTS from underwater noise of vessels	All marine mammal species	No impact				
C5: TTS from underwater noise of vessels	Harbour porpoise, grey seal, harbour seal	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
	All dolphin and whale species	Medium	No impact	No impact		No impact
C5: Disturbance from underwater noise of vessels	Bottlenose dolphin	Medium	Negligible to Low	Minor adverse	None required.	Minor adverse – not significant
	All other marine mammal species	Medium	Negligible	Minor adverse		Minor adverse – not significant
C6: Increased collision risk from construction vessels	Harbour porpoise, white-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin, minke whales, grey seal	High	Negligible	Minor adverse	Best practice measures in CEMP (see **Section 11.7.1**).	Minor adverse – not significant
	Bottlenose dolphin	High	Negligible to Low	Minor to Moderate adverse		Minor adverse – not significant
	Harbour seal	High	Low	Moderate adverse		Minor adverse – not significant
C7: Barrier effect due to underwater noise	All marine mammal species	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
C8: Changes to prey availability	Harbour porpoise, minke whale, humpback whale	Low to Medium	Negligible to Low	Negligible to Minor adverse	None required.	Negligible to Minor adverse – not significant
	All dolphin and seal species	Low	Negligible to Low	Negligible to Minor adverse		Negligible to Minor adverse – not significant

Potential Impact	Receptor	Value / Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Operation & Maintenance						
O1: Underwater noise impacts from operational wind turbines	All marine mammal species	Medium	Low	Minor adverse	None required.	Minor adverse – not significant
O2: PTS from underwater noise during maintenance activities including vessels	All marine mammal species	High	No impact	No impact	None required.	No impact
O2: TTS from underwater noise during maintenance activities including vessels	Harbour porpoise, grey seal, harbour seal	Medium	Negligible	Minor adverse	None required.	Minor adverse – not significant
	All dolphin and whale species	Medium	No impact	No impact		No impact
O2: Disturbance from underwater noise during maintenance activities including vessels	Bottlenose dolphin	Medium	Negligible to Low	Minor adverse	None required.	Minor adverse – not significant
	All other marine mammal species	Medium	Negligible	Minor adverse		Minor adverse – not significant
O3: Barrier effect due to underwater noise	All marine mammal species	Medium	No impact	No impact	None required.	No impact
O4: Increased collision risk from operation vessels	All marine mammal species	High	Negligible	Minor adverse	Best practice measures in CEMP (see **Section 11.7.1**).	Minor adverse – not significant
O5: Entanglement	Harbour porpoise, all dolphin and seal species	Negligible (direct entanglement) Medium (secondary entanglement)	Negligible	Negligible to Minor adverse	Monitoring measures in PEMP (see **Section 11.7.2**).	Negligible adverse – not significant
	All whale species	Negligible (direct entanglement) High (secondary entanglement)	Low	Negligible to Moderate adverse		Negligible to Minor adverse – not significant
O6: EMF effects	All marine mammal species	Low	Low	Minor adverse	None required.	Minor adverse – not significant
O7: Barrier effect due to physical presence of wind farm	All marine mammal species	Negligible	Negligible	Negligible adverse	None required.	Negligible adverse – not significant

Potential Impact	Receptor	Value / Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
O8: Changes to prey resource	Harbour porpoise, minke whale, humpback whale	Low to medium	Negligible	Negligible to Minor adverse	None required.	Negligible to Minor adverse – not significant
	All dolphin and seal species	Low	Negligible	Negligible adverse		Negligible adverse – not significant
Decommissioning						
The same or less than assessment for construction						
PTS from underwater noise: - Cutting of OSP foundations (dependent on method) – based on piling	All marine mammal species	High	Negligible	Minor adverse	MMMP, if required.	Minor adverse – not significant
TTS and Disturbance from underwater noise: - Turbine anchor and mooring substructure removal - OSP foundation removal - Other decommissioning activities - Vessels	All marine mammal species	Medium	Negligible to Low	Minor adverse	None required.	Minor adverse – not significant
Barrier effects from underwater noise	All marine mammal species	Medium	Negligible to Low	Minor adverse	None required.	Minor adverse – not significant
Increased collision risk with vessels	Bottlenose dolphin	High	Negligible to Low	Moderate to Minor adverse	Best practice measures in CEMP (see **Section 11.7.1**).	Minor adverse – not significant
	Harbour seal	High	Low	Moderate adverse		Minor adverse – not significant
	All other marine mammal species	High	Negligible	Minor adverse		Minor adverse – not significant
Changes to prey resources	All marine mammal species	Low to Medium	Negligible to Low	Negligible to Minor adverse	None required.	Negligible to Minor adverse – not significant

Potential Impact	Receptor	Value / Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Cumulative						
CIA1: Cumulative disturbance from underwater noise during piling and construction at the Project	Harbour porpoise, bottlenose dolphin (GNS), minke whale, harbour seal	Medium	Low	Minor adverse	None proposed for the Project due to low contribution to cumulative impacts.	Minor adverse – not significant
	Grey seal	Medium	Medium	Moderate adverse		**Moderate adverse - significant**
	White-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin and humpback whale	Medium	Negligible	Minor adverse		Minor adverse – not significant
CIA2: Cumulative barrier effects from underwater noise or physical disturbance during construction and operation	All marine mammal species	Negligible	Negligible	Negligible adverse	None required.	Negligible adverse – not significant
CIA3: Cumulative increased collision risk with vessels during construction and operation	All marine mammal species	High	Negligible	Minor adverse	None required.	Minor adverse – not significant
CIA4: Cumulative entanglement during operation	All marine mammal species (direct entanglement)	Negligible	Negligible	Negligible adverse	Monitoring at floating wind farms including the Project.	Negligible adverse – not significant
	Harbour porpoise, dolphin and seal species (secondary entanglement)	Medium	Negligible	Minor adverse		Minor adverse – not significant
	Whale species (secondary entanglement)	High	Low	Moderate adverse		Minor adverse – not significant
CIA5: Cumulative changes to prey resources during construction and operation	All marine mammal species	Low to medium	Negligible / No impact	Negligible / No impact to Minor adverse	None required.	Negligible / No impact to Minor adverse
Transboundary						
Considered as part of all assessments as summarised above.						

21.3.6 Offshore and Intertidal Ornithology

Embedded Mitigation

50. **Table 21.6** sets out the relevant embedded mitigation measures that are considered to be of benefit to offshore ornithology receptors to reduce potential effects.

Table 21.6 Relevant offshore ornithology embedded environmental measures

ID	Environmental measure proposed	Project phase measure introduced	How the environmental measures will be secured	Relevance to offshore and intertidal ornithology assessment
1	Initial site selection process for the Windfarm Site. An initial site selection assessment was undertaken using the recently (Cleasby *et al.* 2018) published Royal Society for the Protection of Birds Hotspot mapping GIS data layers. These data were used to help support the selection of the Windfarm Site over sites to the west and due east of the Buzzard oil and gas platform. These data suggested higher seabird numbers than the Windfarm Site and therefore the Windfarm Site was selected. Additionally, in 2019, the site was outside the maximum foraging range for Kittiwake from any Scottish bird colony.	Site selection	Distance from the nearest breeding colony.	Enhanced distance from identified colonies will significantly lower the potential bird numbers observed at site and therefore potential number of seabirds reduced significantly.
2	Development of and adherence to a PEMP which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.	All phases	Required under Section 36 and Marine Licence consent conditions.	Monitor and validate the impacts predicted within **Chapter 12: Offshore and Intertidal Ornithology**.
3	Development of and adherence to a Vessel Management Plan (VMP). The VMP will confirm the types and numbers of vessels that will be engaged on the Project and consider vessel coordination including indicative transit route planning.	All phases	Required under Section 36 and Marine Licence consent conditions.	Reduced the spatial extent and magnitude of impact from disturbance and displacement of construction and maintenance vessels.
4	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	All phases	Required under Section 36 and Marine Licence consent conditions.	Minimise the risk of birds becoming attracted to or disorientated by WTGs at night or in poor weather
5	HDD works at the NorthConnect Parallel landfall option (if chosen) will be undertaken outside the bird breeding season (Apr-Aug incl) to avoid disturbance of cliff nesting birds in the Buchan Ness to Collieston Coast Special Protection Area	Construction phase	The Applicant will commit to this seasonal restriction in HDD works.	HDD works outside the breeding season will avoid disturbance to nesting cliff birds and provisioning.

Summary of Impacts

Table 21.7 Summary of Potential Impacts for Offshore Ornithology

Potential Impact	Receptor	Magnitude	Sensitivity of Receptor	Effect Significance
Construction				
Temporary Disturbance and Displacement: Array	Gannet	Negligible	Medium	Negligible (not significant)
	Guillemot	Negligible	Medium	Minor (not significant)
	Razorbill	Negligible	Medium	Negligible (not significant)
	Puffin	Negligible	Medium	Negligible (not significant)
	Kittiwake	Negligible	Medium	Negligible (not significant)
Temporary disturbance and displacement: Offshore Export Cable Corridors and Landfall	All Receptors	Negligible	N/A	Negligible (not significant)
Indirect effects via changes in prey or habitat availability	All Receptors	Negligible	N/A	Negligible (not significant)
Operation and Maintenance				
Disturbance and displacement: Windfarm Site	Gannet	Negligible	Medium	Negligible (not significant)
	Guillemot	Low	Medium	Minor (not significant)
	Razorbill	Negligible	Medium	Negligible (not significant)
	Puffin	Negligible	Medium	Negligible (not significant)
	Kittiwake	Negligible	Medium	Negligible (not significant)
Disturbance and displacement: Offshore Export Cable Corridors and Landfall	All Receptors	Negligible	N/A	Negligible (not significant)
Indirect effects via changes in prey or habitat availability	All Receptors	Negligible	N/A	Negligible (not significant)
Entanglement with mooring lines	All Receptors	Negligible	N/A	Negligible (not significant)
Collision risk: array	Gannet	Negligible	Medium	Minor (not significant)
	Kittiwake	Negligible	Medium	Minor (not significant)

Potential Impact	Receptor	Magnitude	Sensitivity of Receptor	Effect Significance
	Herring gull	Negligible	Medium	Negligible (not significant)
	Great Black-backed gull	Negligible	Medium	Negligible (not significant)
Combined Operational Displacement and collision risk	Gannet	Negligible	Medium	Minor (not significant)
	Kittiwake	Negligible	Medium	Minor (not significant)
Barrier effects: array	All Receptors	Negligible	Low to Medium	Negligible to Minor (not significant)
Impacts on aviation and navigation lighting: array	All Receptors	Negligible	Low to Medium	Negligible to Minor (not significant)
Decommissioning				
Temporary Disturbance and Displacement: Array	All Receptors	Negligible	N/A	Negligible to Minor (not significant)
Temporary disturbance and displacement: Offshore Export Cable Corridors and Landfall	All Receptors	Negligible	N/A	Negligible (not significant)
Indirect effects via changes in prey or habitat availability	All Receptors	Negligible	N/A	Negligible (not significant)
Cumulative				
Disturbance and displacement: operational phase	Gannet	Low	Medium	Minor (not significant)
	Guillemot	Low	Medium	Minor (not significant)
	Razorbill	Low	Medium	Minor (not significant)
	Puffin	Low	Medium	Minor (not significant)
	Kittiwake	Low	Medium	Minor (not significant)
Collision risk	Gannet	Medium	Medium	Minor (not significant)
	Kittiwake	Medium	Medium	Minor (not significant)
	Herring gull	Low	Medium	Minor (not significant)
	Great Black-backed gull	Medium	Medium	Minor (not significant)
Combined operational displacement and collision risk	Gannet	Low	Medium	Minor (not significant)
	Kittiwake	Low	Medium	Minor (not significant)

Potential Impact	Receptor	Magnitude	Sensitivity of Receptor	Effect Significance
Transboundary				
None identified				

21.3.7 Commercial Fisheries

Embedded Mitigation

51. A summary of the embedded mitigation accounted for in the impact assessment for commercial fisheries is provided below. Full details are given in **Section 13.8.1** in **Chapter 13: Commercial Fisheries.**

52. The Windfarm Site has undergone a number of boundary adjustments. The southeast corner of the Windfarm Site was removed, reducing the site from 123.42 km^2 to 116.79 km^2, following consultation with commercial fisheries stakeholders.

53. Safety Zones will be applied for by the Project as per relevant legislation to ensure safe and effective construction, operation and maintenance of the wind farm. Safety zones for construction, major operation and maintenance and decommissioning will be agreed with MS-LOT and located around any structure where construction work is underwater, partially completed structures where work is not underway and completed structures. These are likely to include:

- 50m radius Safety Zone around each turbine location during the operation phase; and
- 500m radius Safety Zone around each turbine location during the construction phase.

54. Guard vessels will also be used where applicable to ensure adherence with Safety Zones or advisory passing distances to mitigate impacts which pose a risk to surface navigation during construction, operation and maintenance and decommissioning phases.

55. The Project will additionally ensure that there are appropriate communications to inform other marine users of the progression of the works and the notification of significant construction events which have the potential to temporarily restrict areas for safety purposes. These will include:

- A marine coordination centre to monitor vessels contracted by the Project and other marine vessels.
- Notifications to Mariners (NtMs) will be issued to provide updates to other marine users of the construction works that are currently being undertaken and any planned in the near future.
- A notification will be produced in the fortnightly Kingfisher news bulletin or when a significant construction event is planned to occur with the Project.
- Any cardinal or marker buoys associated with the Project will be communicated to the necessary stakeholders and informed through NtMs, United Kingdom Hydrographic Office (UKHO) and Northern Lighthouse Board (NLB).
- The UKHO will be notified of both the commencement (within two weeks), progress and completion of offshore construction works (within two weeks) to allow marking of all installed infrastructure on nautical charts. Details will be provided to UKHO to facilitate appropriate marking of Project infrastructure on appropriate UKHO Admiralty Charts.
- Sharing of as-built cable information through UKHO updates and KIS-ORCA (https://kis-orca.org/), including the locations of buried cables and locations of rock protection.
- Should any cable exposures be identified during the operation and maintenance phase, the location of the exposure will be shared with fisheries stakeholders, and temporary safety measures implemented.

56. A qualified Fisheries Liaison Officer has been appointed by the Project to liaise with the fishing industry during the construction phase. Fisheries liaison will be undertaken in line with good practice guidance where possible, including Recommendations For Fisheries Liaison: Best Practice' guidance

for offshore renewable developers (Fishing Liaison with Offshore Wind and Wet Renewables Group; FLOWW 2014 and 2015). Liaison will additionally be supported by the Project FIR.

57. A Fisheries Management and Mitigation Strategy will be developed.

58. All vessels will follow the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and International Convention for the Safety of Life at Sea 1974 (SOLAS); Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by Trinity House, Maritime and Coastguard Agency (MCA) and Civil Aviation Authority (CAA) and Ministry of Defence (MoD) as appropriate.

59. Development of a procedure for the claim of loss of/or damage to fishing gear.

60. Cables will be installed and maintained in line with good practice guidance. Cable protection will be monitored as per cable suppliers' recommendations, and in agreement with power purchase customers.

61. Cables will be buried where possible. Where this is not possible due to seabed conditions, and external protection is required, the rock berm height and slope will be designed to provide the correct level of protection and long-term stability. In areas where fishing activity is likely, the Applicant will engage with relevant stakeholders to ensure berm design is suitable, accounting for potential impacts to commercial fisheries.

62. Should creeling vessels be required to be removed/relocate during the construction phase, vessels affected will be offered cooperation agreements in line with FLOWW best practice guidance.

63. Assessments will be undertaken post-installation to determine cable burial status (including cable protection) and identify potential changes to seabed conditions. Post cable installation survey data will be reviewed to confirm cable burial status and confirm any areas of cable protection are within specification (e.g. cable crossings). The findings will then be shared with the fishing industry via the Fisheries Liaison Officer and other channels, where appropriate. Recommendations by Fishing Industry Representatives will be considered as appropriate, based on activity levels and the importance of specific areas to the fishing industry. Over-trawl trials will be considered where key fishing areas are identified along the Offshore Export Cable Corridor, as appropriate.

Summary of Impacts

Table 21.8 Summary of Potential Impacts for Commercial Fisheries

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1: Reduction in access to, or exclusion from established fishing grounds during construction	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	Should creeling vessels be required to be removed/relocate during the construction phase, vessels affected will be offered cooperation agreements in line with FLOWW best practice guidance.	Negligible Adverse - Not significant
	Dredging – Scallop Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor Adverse - Not significant
C2: Displacement, leading to fishing gear conflict and increased fishing pressure within adjacent grounds during construction	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	Should creeling vessels be required to be removed/relocate during the construction phase, vessels affected will be offered cooperation agreements in line with FLOWW best practice guidance	Negligible Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Dredging – Scallop Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse - Not significant
C3: Physical presence of offshore wind farm infrastructure leading to fishing gear snagging	All Fisheries	Medium	Low	Minor Adverse	No additional mitigation required	Minor adverse - Not significant
C4: Displacement or disruption of commercially important fish and shellfish resources during construction	See **Chapter 10: Fish and Shellfish Ecology**					
C5: Construction activities leading to additional steaming to alternative fishing grounds	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	Should creeling vessels be required to be removed/relocate during the construction phase, vessels affected will be offered cooperation agreements in line with FLOWW best practice guidance.	Negligible Adverse - Not significant
	Dredging – Scallop Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required	Minor adverse -Not significant
C6: Increased vessel traffic within fishing grounds during construction	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	No additional mitigation required	Minor adverse -Not significant Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
leading to interference with fishing activity	Mobile Fisheries	Low	Low	Negligible Adverse	No additional mitigation required	Negligible Adverse - Not significant Not significant
operation and maintenance						
O1: Reduction in access to, or exclusion from established fishing grounds during operation and maintenance	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Medium	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
	Dredging – Scallop Fishery	Low	Negligible	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
O2: Displacement, leading to fishing gear conflict and increased fishing pressure within adjacent grounds during operation and maintenance	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Medium	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
	Dredging – Scallop Fishery	Low	Negligible	Negligible Adverse	No additional mitigation required.	No Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
O3: Physical presence of offshore wind farm infrastructure leading to fishing gear snagging	All Fisheries	Medium	Low	Minor Adverse	No additional mitigation required	Minor adverse -Not significant
O4: Displacement or disruption of commercially important fish and	See **Chapter 10: Fish and Shellfish Ecology**					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
shellfish resources during operation and maintenance						
O5: operation and maintenance activities leading to additional steaming to alternative fishing grounds	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Medium	Minor Adverse	No additional mitigation required	Minor adverse -Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	No additional mitigation required	Minor adverse -Not significant
	Dredging – Scallop Fishery	Low	Negligible	Negligible Adverse	No additional mitigation required	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required	Minor adverse -Not significant
O6: Increased vessel traffic within fishing grounds during operation and maintenance leading to interference with fishing activity	Creeling – Lobster and Crab Fishery	Medium	Negligible	Minor Adverse	No additional mitigation required	Minor adverse -Not significant
	Mobile Fisheries	Low	Negligible	Negligible Adverse	No additional mitigation required	Negligible Adverse - Not significant
Decommissioning						
D1: Reduction in access to, or exclusion from established fishing grounds during decommissioning	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	Should creeling vessels be required to be removed/relocate during the decommissioning phase, vessels affected will be offered cooperation agreements in line with FLOWW best practice guidance.	Minor adverse -Not significant
	Dredging – Scallop Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
D2: Displacement, leading to fishing gear conflict and increased fishing pressure within adjacent grounds during decommissioning	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Creeling – Lobster and Crab Fishery	Medium	Low	Minor Adverse	Should creeling vessels be required to be removed/relocate during the decommissioning phase, vessels affected will be offered cooperation agreements in line with FLOWW best practice guidance.	Minor adverse -Not significant
	Dredging – Scallop Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
D3: Physical presence of offshore wind farm infrastructure leading to fishing gear snagging	All Fisheries	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
D4: Displacement or disruption of commercially important fish and shellfish resources during decommissioning	See **Chapter 10: Fish and Shellfish Ecology**					
D5: Decommissioning activities leading to additional steaming to alternative fishing grounds	Demersal Fisheries – Nephrops, Squid and Whitefish	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Creeling – Lobster and Crab Fisheries	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
	Dredging – Scallop Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Pelagic Trawling – Herring Fishery	Low	Low	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant
	Inshore Mackerel Fishery	Medium	Low	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
D6: Increased vessel traffic within fishing grounds during decommissioning leading to interference with fishing activity	Creeling – Lobster and Crab Fishery	Medium	Negligible	Minor Adverse	No additional mitigation required.	Minor adverse -Not significant
	Mobile Fisheries	Low	Negligible	Negligible Adverse	No additional mitigation required.	Negligible Adverse - Not significant

21.3.8 Shipping and Navigation

Embedded Mitigation

64. A summary of the embedded mitigation accounted for in the impact assessment for shipping and navigation is provided below. Full details are given in **Section 14.7.1** in **Chapter 14: Shipping and Navigation.**

65. The embedded mitigation measures assumed are listed in **Table 21.9**, which includes details on how each mitigation will be secured.

Table 21.9: Embedded Mitigation Measures

Mitigation	Description	How Secured
Application for Safety Zones	Application to Marine Scotland for safety zones around structures as per relevant legislation (Energy Act 2004 and Electricity Regulations 2007).	Application undertaken in line with the Energy Act 2004, the Electricity Regulations 2007, and the The Department for Business, Energy and Industrial Strategy (BEIS) Guidance on Applying for Safety Zones (BEIS 2011).
Cable burial risk assessment	Implementation and monitoring of cable protection. This will include via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible. • Cable protection will be monitored as per cable suppliers' recommendations, and in agreement with power purchase customers.	Standard consent condition.
Design Specification and Layout Plan	The layout of structures will be agreed with MCA and NLB as part of the DSLP process. This will include consideration of search and rescue (SAR) and surface navigation.	Standard consent condition.
Display on charts	Provision of details to UKHO to facilitate appropriate marking of Project infrastructure on appropriate UKHO Admiralty Charts.	Standard consent condition.
Guard vessels	Use of guard vessel(s) where necessary as identified by risk assessment.	Consideration of use of guard vessels where necessary via risk assessment required under Marine Guidance Note (MGN) 654.
Lighting and Marking Plan	Lighting and Marking Plan setting out how the Project will be lit and marked in agreement with NLB and in line with IALA Guidance G1162/R139 (IALA, 2021). This will include agreement on any construction buoyage requirements.	Standard consent condition.
Marine Coordination	Marine coordination and communication for the purposes of managing project vessel movements.	Approach details in the Vessel Management Plan which is a Standard consent condition.
Marine Pollution Contingency Plan	Implementation of a Marine Pollution Contingency Plan.	Standard consent condition.
MCA & Health and Safety Executive Regulatory Expectations Compliance	Compliance with the Regulatory Expectations on Moorings for Floating Wind and Marine Devices, in particular independent Third Party Verification (TPV) and monitoring / tracking.	MGN 654 requirement.
MGN 654 Compliance	Compliance with MGN 654 and its annexes including Search and Rescue	Standard consent condition.

Mitigation	Description	How Secured
	(SAR) annex 5 (MCA, 2021) and completion of a SAR checklist.	
Minimum blade clearance	Minimum blade clearance of 22m above mean sea level (in line with Royal Yachting Association policy (RYA, 2019) and MGN 654 (MCA, 2021)).	MGN 654 requirement and secured via Project Design.
Navigational Safety Plan	Implementation of a Navigational Safety Plan setting out the navigational safety measures that will be in place during the construction and operational phases.	Standard consent condition.
Project vessel compliance with international marine regulations	Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974).	COLREGS and SOLAS requirements.
Promulgation of information	Promulgation of information via all usual means (e.g., Kingfisher bulletins, Notifications to Mariners).	Approach details in the Navigational Safety Plan which is a Standard consent condition.
Vessel Management Plan	Implementation of a Vessel Management Plan to ensure Project vessel movements are managed to minimise disruption to third party vessels.	Standard consent condition.

Monitoring

66. The Regulatory Expectations also require the provision of continuous monitoring either by Global Positioning System (GPS) or other suitable means, The Applicant will put such a system in place, with each WTG continuously monitored, and with capability of being tracked via AIS in the event of a loss of station as detailed in MGN 654. Each WTG will also have an alarm system in place, whereby an alert will be provided to the Marine Coordination Centre in the event that any floating substructure leaves a pre-defined ringfenced alarm zone. This means in the unlikely event that a floating substructure suffers total loss of station and drifts outside of its alarm zone, the Applicant would be made aware, and would be able to track its position and make the necessary emergency arrangements

Summary of Impacts

Table 21.10 Summary of Potential Impacts Identified for Shipping and Navigation

Potential Impact	Receptor	Frequency of Occurrence	Severity of Consequence	Significance	Additional Mitigation	Residual Impact
Construction						
Vessel Displacement	Third party vessels	Reasonably Probable	Negligible	Broadly Acceptable	n/a	Broadly Acceptable
Restriction of Adverse Weather Routeing	Third party vessels	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Third Party to Third Party Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Third party to Project Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Vessel to Structure Allision	Third party vessels	Extremely Unlikely	Serious	Tolerable	Vessel plotter overlay provision and guidance.	Tolerable with mitigation
Reduced Port Access	Third party vessels	Extremely Unlikely	Minor	Broadly Acceptable	n/a	Broadly Acceptable
Reduction of Emergency Response Capability	Emergency Response	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Operation						
Vessel Displacement	Third party vessels	Remote	Negligible	Broadly Acceptable	n/a	Broadly Acceptable
Restriction of Adverse Weather Routeing	Third party vessels	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Third Party to Third Party Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Third Party to Project Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Vessel to Structure Allision	Third party vessels	Extremely Unlikely	Serious	Tolerable	Vessel plotter overlay provision and guidance.	Tolerable with mitigation
Reduced Port Access	Third party vessels	Extremely Unlikely	Minor	Broadly Acceptable	n/a	Broadly Acceptable

Potential Impact	Receptor	Frequency of Occurrence	Severity of Consequence	Significance	Additional Mitigation	Residual Impact
Reduction of Under Keel Clearance	Third party vessels	Extremely Unlikely	Serious	Tolerable	Post construction validation of available underkeel clearance available over mooring lines in liaison with MCA and NLB. Vessel plotter overlay provision and guidance.	Tolerable with mitigation
Anchor Snagging Interaction	Third party vessels	Negligible	Minor	Broadly Acceptable	n/a	Broadly Acceptable
Loss of Station	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Reduction of Emergency Response Capability	Emergency Response	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Decommissioning						
Vessel Displacement	Third party vessels	Reasonably Probable	Negligible	Broadly Acceptable	n/a	Broadly Acceptable
Restriction of Adverse Weather Routeing	Third party vessels	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Third Party to Third Party Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Third party to Project Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Vessel to Structure Allision	Third party vessels	Extremely Unlikely	Serious	Tolerable	Vessel plotter overlay provision and guidance.	Tolerable with mitigation
Reduced Port Access	Third party vessels	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Reduction of Emergency Response Capability	Emergency Response	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Cumulative						
Vessel Displacement	Third party vessels	Reasonably Probable	Negligible	Broadly Acceptable	n/a	Broadly Acceptable
Third Party to Third Party Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable

Potential Impact	Receptor	Frequency of Occurrence	Severity of Consequence	Significance	Additional Mitigation	Residual Impact
Third party to Project Vessel Collision	Third party vessels	Negligible	Serious	Broadly Acceptable	n/a	Broadly Acceptable
Vessel to Structure Allision	Third party vessels	Extremely Unlikely	Serious	Tolerable	Vessel plotter overlay provision and guidance.	Tolerable with mitigation
Reduction of Emergency Response Capability	Emergency Response	Extremely Unlikely	Moderate	Broadly Acceptable	n/a	Broadly Acceptable
Transboundary						
Captured in the assessment above.						

21.3.9 Offshore Archaeology and Cultural Heritage

Embedded Mitigation

67. A summary of the embedded mitigation accounted for in the impact assessment for offshore archaeology and cultural heritage is provided below. Full details are given in **Section 15.7.2** in **Chapter 15: Offshore Archaeology and Cultural Heritage.**

68. In order to prevent significant effect, the following mitigation has been recommended by MSDS Marine and embedded in the Project design. These largely comprise the application of Archaeological Exclusion Zones (AEZ), Temporary AEZs (TAEZ) or through micrositing of the design. Mitigation measures embedded into the project design are summarised in **Table 21.11**:

Table 21.11: Summary of embedded mitigation

Strategy	Description
Archaeological Exclusion Zones (AEZs)	For archaeologically significant anomalies that are clearly identifiable in the survey data and where the extents are largely known, AEZs have been recommended. AEZs will remain for the life of the project or until ground truthing or higher resolution data determines a reduction in potential, cultural significance, or extents.
Temporary Archaeological Exclusion Zones (TAEZs)	Where an anomaly is not visible in the survey data but likely to exist on the seabed at a known position or where the extents of an anomaly are not fully identifiable, Temporary Archaeological Exclusion Zones (TAEZs) will be recommended. TAEZs have been identified as highly likely to be altered following higher resolution or full coverage data assessment, however, they will remain in place until alterations have been formally agreed.
Areas of Archaeological Potential (AAP)	Areas of Archaeological Potential (AAP) are primarily reserved for magnetic anomalies where, due to line spacing, positions are not accurately known. AAPs demonstrate that there is potentially an anomaly of archaeological significance around the given position. The anomaly is likely to be identified following higher resolution or full coverage data assessment but as the nature and position is not precisely known, no formal exclusion zone is recommended but instead a general awareness of the position is considered appropriate at this phase.

69. In terms of the seabed prehistory, following the collection of engineering led geotechnical cores post-consent, these will undergo a staged program of geoarchaeological assessment and analysis. In brief the process is as follows;

- Stage 1: Geoarchaeological review of core logs;
- Stage 2: Geoarchaeological recording;
- Stage 3: Geoarchaeological assessment;
- Stage 4: Geoarchaeological analysis; and
- Stage 5: Final reporting.

70. In addition to the above, further mitigation measures will include:

- Watching briefs[1] where seabed material is brought to the surface, for example during pre-lay grapnel runs;
- Watching briefs for any intrusive works carried out in the HDD exit zone (during long HDD); and
- The archaeological assessment of any further geophysical and geotechnical data.

[1] *A watching brief is a formal programme of archaeological monitoring that involves attendance by a suitably qualified and experienced archaeologist during groundworks or other site activities/interventions associated with the scheme in the terrestrial or inter-tidal zone, and/ or marine activities such as during offshore obstruction clearance (where considered appropriate).*

71. If anomalies cannot be avoided then additional work may be required to further investigate the nature and extent of anomalies, to establish the archaeological interest and to record them prior to removal. The methodology for such works will be set out post-consent in an **Outline Written Scheme of Investigation (WSI) (Offshore)** (**Appendix 15.2**) and agreed with Historic Environment Scotland prior to works commencing. Any WSI will be undertaken in accordance the *Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects* (The Crown Estate, 2010) and *Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects* (The Crown Estate, 2021).

72. Historic Environment Scotland will also be consulted on the scope of all further post-consent geophysical and geotechnical surveys undertaken for the project. This will ensure that the data generated are sufficiently robust to enable professional archaeological interpretation and analysis.

73. To account for unexpected discoveries of archaeological material during construction, operation and decommissioning, a formal protocol will be established. It is recommended that if any objects of possible archaeological interest are encountered, that they should be reported through a Protocol for Archaeological Discoveries. This will largely follow the principles set out in the *Protocol for Archaeological Discoveries: Offshore Renewables Projects* (The Crown Estate, 2014) and will establish whether the objects are of archaeological interest and recommend appropriate mitigation measures where necessary.

Summary of Impacts

Table 21.12 Potential Impacts Identified for Offshore Archaeology and Cultural Heritage

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of Impact	Significance of Effect	Mitigation Measures Proposed	Residual Effect	Cumulative Residual Effect
Construction							
C1: Direct impact to known heritage assets	Wrecks and anomalies of archaeological interest (GV22_0008 *Ernst Friesecke*)	No impact due to application of AEZs					
	Historic wrecks for which remains have yet to be identified	No impact due to application of AEZs					
	Additional anomalies of possible archaeological interest	No impact due to avoidance of these locations through micrositing					
	Intertidal Assets (WWII defensive structures)	No impact due to avoidance of these locations using HDD					
C2: Direct impact to potential heritage assets	*In-situ* prehistoric, maritime or aviation sites	High	High	Minor adverse – not significant	Further assessment and investigation and additional mitigation to avoid, reduce or offset impacts.	Minor adverse – not significant	Potential beneficial effect (described but currently not quantifiable, to be realised post-consent through provision of publicly accessible data)
	Intertidal assets	No impact					
	Isolated finds	Medium	Low	Minor adverse – not significant	Protocol for archaeological discoveries.	Minor adverse – not significant	
C3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	No impact					
C4: Impacts to the setting of heritage assets	Known and potential heritage assets	No impact					
Operation							

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of Impact	Significance of Effect	Mitigation Measures Proposed	Residual Effect	Cumulative Residual Effect
O1: Direct impact to known heritage assets	Known heritage assets	No impact due to application AEZs					
O2: Direct impact to potential heritage assets	*In-situ* prehistoric, maritime or aviation sites	High	High	Minor adverse – not significant	Further assessment of geophysical and geotechnical data post-consent.	Minor adverse – not significant	Potential beneficial effect (described but currently not quantifiable, to be realised post-consent through provision of publicly accessible data)
	Isolated finds	Medium	Low	Minor adverse – not significant	Protocol for archaeological discoveries.	Minor adverse – not significant	
O3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	No impact as Chapter 7: Marine Geology, Oceanography and Physical Processes concluded impacts would be low as a worst case. As such there will be no impact to the cultural significance of heritage assets.					
O4: Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to High	Low	Minor negligible – not significant	N/A	Minor negligible – not significant	Minor negligible – not significant
	WWII defensive structures	No impact as the turbines will not be visible from shore. Similarly, construction activities within the intertidal zone will be temporary and will therefore not result in a long lasting change.					
Decommissioning							
D1: Direct impact to known heritage assets	Known heritage assets	No impact due to application AEZs					
D2: Direct impact to potential heritage assets	*In-situ* prehistoric, maritime or aviation sites	High	High	Minor adverse – not significant	Further assessment of geophysical and geotechnical data post-consent.	Minor adverse – not significant	Potential beneficial effect (described but currently not quantifiable, to be realised post-consent through provision of publicly accessible data)
	Isolated finds	Medium	Low	Minor adverse – not significant	Protocol for archaeological discoveries.	Minor adverse – not significant	
D3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	No impact as the types of effect will be comparable to those identified for the construction phase.					

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of Impact	Significance of Effect	Mitigation Measures Proposed	Residual Effect	Cumulative Residual Effect
D4: Impacts to the setting of heritage assets	Known and potential heritage assets	No impact					

21.3.10 Aviation and Radar

Embedded Mitigation

74. A summary of the embedded mitigation accounted for in the impact assessment for aviation and radar is provided below. Full details are given in **Section 16.7.1** in **Chapter 16: Aviation and Radar**.

75. During construction, details of the tow to site route and the times at which the tow will take place will be made available to NATS and the helicopter operators prior to the tow taking place (these will be weather dependent) via Notice to Air Missions (NOTAM).

76. The temporary introduction of new, tall obstacles presents a collision risk if not mitigated. Mitigation will be in the form of notification to airspace users and aviation obstacle lighting during conditions of poor visibility, as deployed by tall cranes. Notification is conducted through the formal NOTAM process.

77. MCA guidelines will be observed in designing the site and managed within the Emergency Response Co-operation Plan to mitigate SAR risks. Visual Flight rules corridors no less than 1 nm wide, will be established that meet SAR access lane requirements, also serving as transit corridors and facilitating construction or maintenance flights.

78. Wind turbines will be fitted with obstacle lighting, in line with Air Navigation Order 2016.

Summary of Impacts

Table 21.13 Potential Impacts Identified for Aviation and Radar

Potential Impact	Receptor	Significance of Effect	Mitigation	Residual Effect
Construction				
Temporary obstruction during tow	Helicopter main routes	Not significant	NOTAM notifications	Not significant
Operation				
Radar impact	Military and civilian Radar	Significant	Upgrade to current radar system both technical and equipment	Not significant Initial solution is temporary to the radar impact and an enduring solution is expected to follow in late 2020s/early 2030s (as per the Offshore Wind Industry Council working group timelines)
Radar impact	Aberdeen Airport	Significant	Upgrade to radar (software)	Not significant
Flight operation	Helicopter main routes	Not significant	Mitigation options include layout of the site, rerouting of helicopter routes and NOTAM notifications	Not significant
Decommissioning				
Temporary obstruction during tow	Helicopter main routes	Not significant	NOTAM notifications	Not significant
Cumulative				
None identified				
Transboundary				
None identified				

21.3.11 Infrastructure and Other Marine Users

Embedded Mitigation

79. A summary of the embedded mitigation accounted for in the impact assessment for infrastructure and other marine users is provided below. Full details are given in **Section 17.7.1** in **Chapter 17: Infrastructure and Other Marine Users.**

80. As part of the site selection and design process the Project has identified and avoided existing marine infrastructure in the Offshore Development Area, including minimising the number cable and pipeline crossings. Details of the site selection process is provided in **Chapter 4: Site Selection and Assessment of Alternatives** of this **Offshore EIA Report**.

81. Provision will be made to allow ongoing monitoring for potential for hazards to other users of the sea and to ensure there is recovery of the environment after decommissioning of oil and gas assets. The WTG array pattern and position applied will deliberately avoid placing turbines and substructures directly above pipelines and umbilicals remaining in-situ, and abandoned well-centres at the seabed. The final offsets applied will be determined by collaboration with the oil and gas operator via a structured risk assessment approach. Positioning of wind farm equipment on the seabed such as moorings and inter-array cables will also avoid interaction where possible, however, there is a strong likelihood that crossings will be necessary. Such crossings will be finalised with the input and agreement with the oil and gas operator since they will be legally responsible for the notification process and the ongoing liability associated with the decommissioned equipment affected by the crossing.

82. Safety Zones will be applied for by the Project as per relevant legislation to ensure safe and effective construction, operation and maintenance of the wind farm. Safety zones for construction, major operation and maintenance and decommissioning will be agreed with MS-LOT and located around any structure where construction work is underwater, partially completed structures where work is not underway and completed structures. These are likely to include:

- 50m radius Safety Zone around each turbine location during the operation phase; and
- 500m radius Safety Zone around each turbine location during the construction phase.

83. The Project will additionally ensure that there are appropriate communications to inform other marine users of the progression of the works and the notification of significant construction events which have the potential to temporarily restrict areas for safety purposes. These will include:

- A marine coordination centre to monitor vessels contracted by the Project and other marine vessels.
- NtMs will be issued to provide updates to other marine users of the construction works that are currently being undertaken and any planned in the near future.
- A notification will be produced in the fortnightly Kingfisher news bulletin or when a significant construction event is planned to occur with the Project.
- Any cardinal or marker buoys associated with the Project will be communicated to the necessary stakeholders and informed through NtMs, UKHO and NLB. The information will include detailed maps and coordinates to enable the continuing navigational safety for other marine users.
- Details will be provided to UKHO to facilitate appropriate marking of Project infrastructure on appropriate UKHO Admiralty Charts.

84. As detailed in **Chapter 16: Shipping and Navigation**, a series of plans will be developed to protect other marine users, including:

- Vessel Management Plan;
- Navigational Safety Plan;
- Marine Pollution Contingency Plan;
- Development Specification and Layout Plan; and
- Lighting and Marking Plan.

85. Further mitigation measures will be incorporated for the relevant phases of Project development including:

- Pre-construction surveys will be implemented by the Project in order to identify any potential hazards within the Windfarm Site and offshore export cable corridors. These will include geophysical surveys to identify seabed hazards such as discarded fishing gear, wrecks or unidentified objects and magnetometer surveys to identify for the presence of UXO devices. Any identified UXO devices would be avoided through micrositing or require a subsequent UXO clearance campaign.
- All cables will be installed and maintained in line with standard industry guidance and good practice (e.g. Department for Energy and Climate Change (DECC), 2011, and other guidance, as appropriate) that provide guidance on proximity of cables to existing assets and coordination with other operators.
- Inter-array, OSP interconnector and offshore export cables will be buried beneath the seabed to a burial depth of 0.6 m to 1.5 m, wherever practicable, in line with DECC, 2011 guidance and other guidance as appropriate. Cable protection measures will be applied in areas where burial is not possible, e.g. where the cables are required to cross existing cables or in areas where hard seabed are encountered. This will enable a reduction in the potential for interactions between other marine users and the deployed cabling infrastructure associated with the Project. Cable protection will be monitored as per cable suppliers' recommendations, and in agreement with power purchase customers.
- Owners and operators of existing or proposed infrastructure and petroleum blocks / licences (including oil and gas companies, other wind farm developers, and electrical and telecommunication cable and pipeline operators) are, and will continue to be, consulted by the Applicant and commercial and technical cable crossing agreements and / or Block Crossing Agreements will be put in place where required.
- Crossing and proximity agreements will be agreed post-consent with the relevant asset owners.
- The Project will comply with all cabling industry standards in locations where the cables are buried.
- Ongoing TPV will be undertaken for all mooring systems (including modification). In addition, the Applicant will put a continuous GPS in place, which will be continuously monitored, with capability of being tracked via Automatic Identification Systems (AIS) in the event of a loss of WTG. Each WTG will also have an alarm system in place, whereby an alert will be provided to the Marine Coordination Centre in the unlikely event that any floating substructure leaves a pre-defined ringfenced alarm zone.

Summary of Impacts

Table 21.14 - Potential Impacts Identified for Infrastructure and Other Marine Users

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
C1: Disturbance of existing offshore wind farms	Vessels	High	Negligible	Minor adverse	No additional mitigation required	Minor adverse – not significant
C2: Disturbance of oil and gas operational and decommissioning activities	Oil and gas activities	Medium	Negligible	Minor adverse	No additional mitigation required	Minor adverse– not significant
C3: Disturbance of marine disposal sites	Vessels	Low	Negligible	Negligible	No additional mitigation required	Negligible – not significant
C4: Disturbance of existing subsea electrical cables	Sub-sea electrical cables	Negligible	Negligible	Negligible	No additional mitigation required	Negligible – not significant
Operation						
O1: Disturbance of existing offshore wind farms	Vessels	Medium	Negligible	Minor adverse	No additional mitigation required	Minor adverse – not significant
O2: Disturbance of oil and gas operational and decommissioning activities	Oil and gas activities	Medium	Negligible	Minor adverse	No additional mitigation required	Negligible to Minor adverse – not significant
O3: Disturbance of marine disposal sites	Vessels	Low	Negligible	Negligible	No additional mitigation required	Negligible– not significant
O4: Disturbance of existing subsea electrical cables	Sub-sea electrical cables	Medium	Negligible	Minor adverse	No additional mitigation required	Minor adverse – not significant
Decommissioning						
D1: Disturbance of marine infrastructure	Vessels, oil and gas activities, subsea cables and pipelines	Up to High	Negligible	Negligible to Minor adverse	No additional mitigation required	Negligible to Minor adverse – not significant

21.3.12 Climate Change

Embedded Mitigation

86. The floating substructures for the Project provide several benefits over conventional fixed foundations, including reductions in construction materials, piling operations and use of very large offshore construction vessels. As such, there are likely to be GHG savings associated with the Project design, requiring less construction activities and enabling more efficient construction (i.e 'design clever'). As such, it is considered that the Project meets the requirements of the Institute of Environmental Management and Assessment guidance with regard to mitigation. Further details are provided in **Chapter 18: Climate Change**.

Summary of Impacts

Table 21.15 Summary of Potential Impacts Identified for Climate Change

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction, Operation and Decommissioning						
GHG emissions during construction, operation and decommissioning	Global atmosphere	High	N/A – not defined as part of the assessment methodology	Beneficial	N/A	Beneficial
Cumulative						
Cumulative impacts in relation to GHGs do not require assessment						
Transboundary						
Transboundary impacts were not explicitly considered within the assessment						

21.3.13 Socioeconomics, Tourism and Recreation

Embedded Mitigation

87. There are no embedded mitigations considered for socioeconomics receptors, as it is anticipated that the overriding socioeconomic impacts of the Project will be positive in nature and consent conditions are not expected in relation to socioeconomic effects. In this instance, mitigation can therefore be more usefully interpreted as enhancement of positive impacts. Consultation is being carried out with local stakeholders, business and tourism groups and public sector bodies, such as Scottish Enterprise, and through other activities that raise awareness of the potential opportunities that the Project provides to maximise the positive socioeconomic impacts.

88. As the Project moves into the procurement phase it will seek to maximise local content, where possible. Supply chain events in Scotland will be held to enable local businesses to engage with the Project. There is also a supply chain contact form available on the Green Volt website to enable local suppliers to contact the Project [2]. The Supply Chain Development Strategy (SCDS) for the Project will be developed following the offer of an Innovation and Targeted Oil and Gas (INTOG) Decarbonisation Exclusivity Agreement by Crown Estate Scotland. The SCDS would be provided to Crown Estate Scotland in advance of any Option Agreement being executed.

89. As the Project evolves, the Applicant will ensure up to date information is provided to local communities and other stakeholders on progress. The Applicant will endeavour to make the information accessible to those that may be affected. The Project website will be used to share information and alternatives for reaching the appropriate audiences will be considered, as necessary. The Project website includes a contact form to enable feedback to be provided to the Project at any time or else emails can be sent to *hello@greenvoltoffshorewind.com*.

90. Any offshore wind projects within Scottish waters can submit a Safety Zone application to Marine Scotland which will require other marine users to keep a minimum safe distance from a Project contracted vessel or marine infrastructure, such as incomplete offshore wind foundations. The purpose of the Safety Zones is to protect infrastructure that is being installed or vessels which require a large area to operate safely.

91. Safety Zones will be applied for by the Project as per relevant legislation to ensure safe and effective construction, operation and maintenance of the wind farm. Safety zones for construction, major operation and maintenance and decommissioning will be agreed with MS-LOT and located around any structure where construction work is underwater, partially completed structures where work is not underway and completed structures. These are likely to include:

- 50m radius Safety Zone around each turbine location during the operation phase; and
- 500m radius Safety Zone around each turbine location during the construction phase.

92. The Project will additionally ensure that there are appropriate communications to inform other marine users of the progression of the works and the notification of significant construction events which have the potential to temporarily restrict areas for safety purposes. These measures are detailed in **Chapter 14: Shipping and Navigation** and will include:

- A marine coordination centre to monitor vessels contracted by the Project and other marine vessels.
- NtM will be issued to provide updates to other marine users of the construction works that are currently being undertaken and any planned in the near future.

[2] *https://greenvoltoffshorewind.com/#supply*

- A notification will be produced in the fortnightly Kingfisher news bulletin or when a significant construction event is planned to occur with the Project.
- Any cardinal or marker buoys associated with the Project will be communicated to the necessary stakeholders and informed through NtMs, UKHO and NLB. The information will include detailed maps and coordinates to enable the continuing navigational safety for other marine users.
- Details will be provided to UKHO to facilitate appropriate marking of Project infrastructure on appropriate UKHO Admiralty Charts.

Summary of Impacts

Table 21.16 Summary of Potential Impacts Identified for Socioeconomics, Tourism and Recreation

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
Direct Employment	Construction employment	N/A	High Beneficial	Major Beneficial	None required	Major Beneficial - Significant
Supply chain impacts	Indirect/induced GVA	National	Medium Beneficial	Moderate Beneficial	None required	Moderate Beneficial - Significant
Increase in demand for local private services/goods	Local services and businesses	High Local	Low Beneficial	Minor Beneficial	None required	Minor Beneficial – not significant
Interference with planned infrastructure improvements in the local area	Local infrastructure improvement projects	Low Local	Negligible	Negligible	None required	Negligible – not significant
Impact on recreational activities	Local recreation users, both in terms of water sports and coastal path users	High Local - Regional	Low	Minor Adverse	None required	Minor Adverse – not significant
Operation						
Direct Employment	Operation employment	N/A	Low Beneficial	Minor Beneficial	None required	Minor Beneficial – not significant
Supply chain impacts	Indirect/induced GVA	Regional	Low	Negligible	None required	Negligible – not significant
Increase in demand for local private services/goods	Local services and businesses	High Local	Low	Negligible	None required	Negligible – not significant
Interference with planned infrastructure improvements in the local area	Local infrastructure improvement projects	Low Local	Negligible	Negligible	None required	Negligible – not significant
Impact on recreational activities	Local recreation users, both in terms of water sports and coastal path users	High Local - Regional	Low	Minor	None required	Minor – not significant
Decommissioning						

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Direct Employment	Decommissioning employment	N/A	Low Beneficial	Minor Beneficial	None required	Minor Beneficial – not significant
Supply chain impacts	Indirect/induced GVA	Regional	Low Beneficial	Negligible	None required	Negligible – not significant
Increase in demand for local private services/goods	Local services and businesses	High Local	Low Beneficial	Negligible	None required	Negligible – not significant
Interference with planned infrastructure improvements in the local area	Local infrastructure improvement projects	Low Local	Negligible	Negligible	None required	Negligible – not significant
Impact on recreational activities	Local recreation users, both in terms of water sports and coastal path users	Regional	Negligible	Negligible	None required	Negligible – not significant
Cumulative						
Construction: Direct Employment and Supply Chain Impacts	Construction employment	N/A	Low Beneficial	Minor Beneficial	None required	Minor Beneficial – not significant
Construction: Increase in demand for local private services/goods	Local services and businesses	High Local	Negligible	Minor Beneficial	None required	Minor Beneficial – not significant
Construction: Impact on recreational activities	Local recreation users, both in terms of water sports and coastal path users	Low Local	Negligible	Negligible	None required	Negligible – not significant
Operation: Direct Employment and Supply Chain Impacts	Operation employment	N/A	Medium Beneficial	Moderate Beneficial	None required	Moderate Beneficial - signifcant
Decommissioning	As for cumulative construction					
Transboundary						
None identified						

21.4 Southern Trench MPA

93. As discussed in **Chapter 3: Policy and Legislative Context**, Scotland designates Nature Conservation Marine Protected Areas (MPAs) within 12 nm under the Marine (Scotland) Act 2010. MPAs are designated to protect biodiversity and heritage, with specific focus on protected features (species, habitats, large scale features or geomorphological features). Where a project may have risk of hindering the achievement of the MPA's conservation objectives, the EIA Report for the project should include the necessary information to inform an MPA assessment. The MPA assessment is undertaken by the Public Authority (Scottish Ministers for marine licenses and s.36 consents) in consultation with NatureScot/JNCC. This **Offshore EIA Report** provides the required information to inform the MPA assessment for the Southern Trench MPA. A detailed impact assessment is provided in **Chapter 9: Benthic Ecology** and **Chapter 11: Marine Mammal Ecology** for screened in protected features and also summarised in **Table** 21.17.

94. The Offshore Export Cable Corridor route is sufficiently distance from the Turbot Bank MPA to not cause any direct or indirect effects on the site that may hinder conservation objectives, and the Turbot Bank MPA is therefore not considered.

Table 21.17 Summary of Impact Assessment for Protected Features of the Southern Trench MPA

Type	Protected Features	Conservation Objective	Scoped in?	Potential Impact Pathways	Rationale	Significance of Effect

Species	Minke Whales	Maintain the feature in favourable condition:
		• The species is conserved to include continues access by the species to resources provided by the MPA for, but not restricted to, feeding, courtship, spawning or use as nursery ground;
		• The extent and distribution of any supporting feature upon which the species is dependent is conserved;
		• The structure and function of any supporting feature, including any associated processes supporting the species within the MPA, is such as to ensure that the protected feature is in a condition which is healthy.
			Yes - Chapter 11: Marine Mammal Ecology	• Auditory injury and disturbance from underwater noise during geophysical surveys.
				• Physical injury, auditory injury and disturbance from underwater noise during UXO clearance.
				• Auditory injury and disturbance from underwater noise during piling, including use of ADD.
				• Disturbance impacts from underwater noise during other construction activities, such as cable installation and turbine mooring installation.
				• Disturbance from underwater noise and presence and movements of construction vessels.
				• Increased collision risk with vessels.
				• Barrier effects as a result of underwater noise.
				• Changes to prey resources.
				• Underwater noise and disturbance from:
				  ○ Operational wind turbines
				  ○ Maintenance activities such as cable laying
				  ○ Vessels
				• Entanglement.
				• EMF.
				• Barrier effects from physical presence of windfarm.
				• Underwater noise during turbine anchor and mooring substructure removal.
					Offshore Export Cable Corridor overlaps with the Southern Trench MPA	No significant effects identified for minke whale – there is no significant risk of hindering the achievement of the conservation objectives as a result of the Project

Type	Protected Features	Conservation Objective	Scoped in?	Potential Impact Pathways	Rationale	Significance of Effect
				• Underwater noise during OSP foundation removal (depended on type of foundation and method used). • Underwater noise and disturbance from other decommissioning activities, such as cable removal, rock protection removal or scour protection removal, if required. • Underwater noise and disturbance from vessels.		
Habitats	Burrowed Mud	Maintain the feature in favourable condition: • Its extent is stable or increasing; and • Its structures and functions, its quality, and the composition of its characteristic biological communities are such as to ensure that it is in a condition which is healthy and not deteriorating	Yes - Chapter 9: Benthic Ecology Chapter 7: Marine Geology, Oceanography and Physical Processes	• Potential Impacts on the Southern Trench Marine Protected Area	Offshore Export Cable Corridor overlaps with the Southern Trench MPA	No significant effects identified for burrowed muds - there is no significant risk of hinder the achievement of the conservation objectives as a result of the Project
Large scale feature	Fronts Shelf Deeps	Maintain the feature in favourable condition: • The extent, distribution and structure of that feature is maintained; • The function of that feature is maintained so as to ensure that it continues to support its characteristic biological communities and their use of the site including for, but not restricted to, feeding, courtship, spawning or use as nursery grounds; and	No	No impact pathway	Offshore Export Cable Corridor overlaps with the Southern Trench MPA	Project will not hinder conservation objectives

Type	Protected Features	Conservation Objective	Scoped in?	Potential Impact Pathways	Rationale	Significance of Effect
		• The processes supporting that feature are maintained.				
Geology	Quaternary of Scotland: Moraines Quaternary of Scotland: Sub-glacial tunnel valleys Submarine Mass Movement: Slide scars	Maintain the feature in favourable condition: • Its extent, component elements and integrity are maintained; • Its structure and functioning are unimpaired; and • Its surface remains sufficiently unobscured.	No - Chapter 7: Marine Geology, Oceanography and Physical Processes	No impact pathway	Offshore Export Cable Corridor does not pass near the marine muds of the Southern Trench MPA and do not impact the designated features	Project will not hinder conservation objectives

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