Environmental Impact Assessment Report

NISA

North Irish Sea Array

Volume 3: Offshore Chapters

Chapter 18
Offshore Archaeology and Cultural Heritage

Statkraft

CIP
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GoBe
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18. Offshore Archaeology and Cultural Heritage

18.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents an assessment of likely significant effects from the North Irish Sea Array (NISA) Offshore Wind Farm (hereafter referred to as the 'proposed development') in relation to offshore archaeology and cultural heritage during the construction, operation and decommissioning phases.

This chapter sets out the methodology followed (Section 18.2), describes the baseline environment (Section 18.3) and summarises the main characteristics of the proposed development which are of relevance to offshore archaeology and cultural heritage (Section 18.4) including any embedded mitigation. Potential impacts and relevant receptors are identified, and an assessment of likely significant effects on offshore archaeology and cultural heritage is undertaken, details of which are provided (Section 18.5).

Additional mitigation measures are proposed to mitigate and monitor these effects if required (Section 18.6) and any residual likely significant effects are then described (Section 18.7). Transboundary effects are considered in Section 18.8 and cumulative effects are considered in Section 18.9. The results are summarised in Volume 6, Chapter 38: Cumulative and Inter-Related Effects. The chapter then provides a reference section (Section 18.10).

The EIAR also includes the following:

- Detail on the competent experts that have prepared this chapter is provided in Volume 9, Appendix 1.1: Competent Experts;
- Detail on the extensive consultation that has been undertaken with a range of stakeholders during the development of the EIAR including those relating to offshore archaeology and cultural heritage is set out in Volume 9, Appendix 1.2: Consultation Report; and
- A glossary of terminology, abbreviations and acronyms is provided at the beginning of Volume 2 of the EIAR.

A detailed description of the proposed development including construction, operation and decommissioning is provided in Volume 2, Chapter 6: Description of the Proposed Development – Offshore (hereafter referred to as the 'Offshore Description Chapter'), and Volume 2, Chapter 8: Construction Strategy – Offshore (hereafter referred to as the 'Offshore Construction Chapter').

The assessment should be read in conjunction with the following linked EIAR chapters within Volume 3:

- Chapter 10: Marine Geology, Oceanography and Physical Processes (hereafter referred to as the Physical Processes Chapter).

This chapter should also be read alongside the following:

- Volume 4, Chapter 25: Onshore Archaeology, Architectural and Cultural Heritage;
- Volume 9, Appendix 18.1: Palaeogeographical Investigation;
- Volume 9, Appendix 18.2: Wreck Sheets;
- Volume 9, Appendix 18.3: Maritime and Aviation Archaeology Baseline;
- Volume 9, Appendix 18.4: Intertidal Archaeology Baseline; and
- Volume 9, Appendix 18.5: Recorded Losses.

All figures referred to in this Chapter are provided in Volume 7A.

18.2 Methodology

18.2.1 Introduction

The assessments of offshore archaeology and cultural heritage are consistent with the EIA methodology presented in Volume 2, Chapter 2: EIA and Methodology for the preparation of an EIAR (hereafter referred to as the EIAR Methodology chapter).

18.2.2 Study Area

The offshore archaeology and cultural heritage study areas were initially identified at the proposed development scoping stage, in line with Department of Communications, Climate Action and Environment (DCCAE) (now the Department of the Environment, Climate and Communications; DECC) Guidance (DCCAE, 2017) (See Appendix 2.1: Scoping Report).

The extent of the offshore archaeology and cultural heritage study area has been determined by the array area, offshore Export Cable Corridor (ECC) (collectively referred to as 'offshore development area' hereafter) and the intertidal area to the High Water Mark (HWM) (Figure 18.1). The study area is extended by a 1km buffer from the offshore development area to capture records of known offshore archaeology and cultural heritage that may be close to, or partly within, the offshore development area, and to identify potential for offshore archaeology and cultural heritage from a wider context, whilst making allowances for marine heritage records which often have imprecise locations (see below in Section 18.3). This 1km buffer does not extend landward of the HWM.

The coordinate system used within this chapter of the EIAR is ETRS89 UTM30N.

18.2.3 Relevant Guidance and Policy

This section outlines guidance and policy specific to offshore archaeology and cultural heritage, including best practice guidelines. Overarching guidance on EIA is presented in the EIAR Methodology Chapter. Furthermore, policy applicable to the proposed development is detailed in Volume 2, Chapter 3: Legal and Policy Framework.

The assessment of likely significant effects upon offshore archaeology and cultural heritage has been made with specific reference to the following identified relevant legislation and guidance:

- Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023; and
- Marine Area Planning Act 2021.

Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023

This Act introduces new measures to protect archaeological structures and sites, including the establishment of a single Register of Monuments, a statutory reporting scheme for newly discovered monuments and provisions to prevent the illicit import and possession of stolen cultural property. This Act incorporates historic wrecks (including all those over 100 years old) and underwater cultural archaeological objects into the new scheme for monument protection.

Marine Area Planning Act 2021

This Act was established to regulate the maritime area, achieved by means of a National Marine Planning Framework (NMPF) (2021), providing maritime area consents and licences for the occupation of the maritime area for maritime usages and to establish a Maritime Area Regulatory Authority (MARA) to grant, revoke and suspend such consents and licences. Responsibility for heritage within the planning system falls with the Minister for Housing, Local Government and Heritage.

The principal guidance and best practice documents used to inform the assessment of potential impacts on offshore archaeology and cultural heritage are summarised below. Where specific guidance is not available for Ireland, best practice guidance documents from other jurisdictions have been referred to. The guidance specific to Ireland is as follows:

- Framework and Principles for the Protection of the Archaeological Heritage (Department of Arts, Heritage, Gaeltacht and the Islands, 1999); and
- Conserving Ireland's Maritime Heritage, Proposing Policies and Priorities for the National Heritage (The Heritage Council, 2006).

Best-practice guidance consulted from other jurisdictions includes:

- Identifying and Protecting Palaeolithic Remains: Archaeological Guidance for Planning Authorities and Developers (English Heritage (now Historic England), 1998);
- Managing Lithic Scatters: Archaeological Guidance for planning authorities and developers (English Heritage (now Historic England), 2000);
- Military Aircraft Crash Sites: Guidance on their significance and future management (English Heritage (now Historic England), 2002);
- The Code of Practice for Seabed Developers (Joint Nautical Archaeology Policy Committee and The Crown Estate, 2006);
- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology 2007);
- Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage (now Historic England), 2008);
- Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition) (English Heritage (now Historic England), 2011);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble & Leather, 2011);
- Ships and Boats: Prehistory to Present: Designation Selection Guide (English Heritage (now Historic England), 2012);
- Standard and Guidance for Historic Environment Desk-based Assessment (Chartered Institute for Archaeologists (CIfA), 2014, updated 2017);
- Marine Geophysics Data Acquisition, Processing and Interpretation Guidance Notes (English Heritage (now Historic England), 2013); and
- Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record (Historic England, 2015).

The key National Marine Planning Framework (NMPF) policy that is applicable to the assessment of offshore archaeology and cultural heritage is summarised in Table 18.1. NMPF policies are addressed in their entirety in Appendix 3.1: NMPF Compliance Report.

Table 18.1: Key NMPF policies relevant to the assessment

Policy Name	Policy Description	Where addressed
National Marine Planning Framework (2021)	**Heritage Assets Policy 1** Proposals that demonstrate they will contribute to enhancing the significance of heritage assets will be supported, subject to the outcome of statutory environmental assessment processes and subsequent decision by the competent authority, and where they contribute to the policies and objectives of this NMPF. Proposals unable to contribute to enhancing the significance of heritage assets will only be supported if they demonstrate that they will, in order of preference:	The construction, operation and decommissioning activities of an offshore wind farm has the potential to cause direct disturbance and/or damage to offshore archaeology and cultural heritage receptors. The assessment contained in this chapter of the EIAR demonstrates that the potential harm to heritage assets will be avoided, minimised or mitigated so that the residual effects are not significant in EIA terms (see Sections 18.5, 18.6 and 18.7).

Policy Name	Policy Description	Where addressed
	a) avoid, b) minimise, or c) mitigate harm to the significance of heritage assets, and d) if it is not possible, to mitigate harm, then the public benefits for proceeding with the proposal must outweigh the harm to the significance of the heritage assets.	

18.2.4 Site-specific Surveys

Site-specific surveys were undertaken for the proposed development and used to inform the offshore archaeology and cultural heritage chapter.

In order to provide site-specific and up to date information on which to base the impact assessment, an intertidal walkover survey was conducted on 22/09/2022 (ADCO 2023a). This survey alongside data sources listed in Table 18.2 have been used to inform the intertidal baseline assessment in this EIAR chapter and a gazetteer has been created based on the survey results, presented in Appendix 18.4.

Geophysical surveys within the offshore development area were undertaken by Fugro and N-Sea Ltd, with archaeological advice and reporting from ADCO Ltd, as per the requirements of Foreshore Licences FS007031 and FS007358 held by the Developer.

These data included (Magnetometer (Mag.), Sidescan Sonar (SSS), Sub-Bottom Profiler (SBP), Multibeam Echosounder (MBES) bathymetry and Multibeam Backscatter (MBBS)). Archaeological assessment of the results of these surveys was completed by ADCO Ltd (ADCO 2022; ADCO 2023b).

Additional archaeological assessment of the SBP data to identify potential for seabed prehistory was completed by Wessex Archaeology and forms Appendix 18.1.

18.2.5 Desk-based Review

In addition to the site-specific surveys, a desk-based review was undertaken to inform the baseline for offshore archaeology and cultural heritage. Key data sources used to inform the assessment are set out in Table 18.2.

Table 18.2: Data sources

Data	Source	Date	Notes
Wreck Inventory of Ireland Database (WIID)	National Monuments Service	24/08/2023	Data used to inform receptor gazetteer- Recorded Losses
Sites and Monuments Record (SMR)	Archaeological Survey of Ireland, National Monuments Service (NMS)	25/08/2023	Data used to inform receptor gazetteer
Topographical files	National Museum of Ireland	25/08/2023	Data used to inform receptor gazetteer
Wreck and obstructions database	United Kingdom Hydrographic Office (UKHO)	29/08/2023	Data used to inform receptor gazetteer

18.2.6 Data Limitations

The assessment has been undertaken based on the following assumptions:

- Data used to compile this report includes secondary information derived from a variety of sources as detailed in Section 18.2.4.2 of this chapter. The assumption is made that the secondary data, as well as that derived from other secondary sources, are adequately accurate for the purposes of EIA; and
- The records held by the UKHO, NMS and the other sources used in this assessment are not a record of all surviving cultural heritage receptors, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown. This relates to currently unknown buried archaeological receptors.

18.2.6.1 Geophysical data sources

A number of geophysical data sources were consulted during this assessment to develop the baseline sources into spatially defined receptors suitable for impact assessment and defining relevant mitigation strategies, if required, including:

- Foreshore Licence-related archaeological technical reports from ADCO Ltd. (ADCO, 2021; 2022; 2023a; 2023b);
- Developer-acquired geophysical technical reports from Fugro (Fugro, 2022) and N-Sea (N-Sea, 2023);
- Recorded wreck and obstruction data acquired via the UKHO and the Republic of Ireland's NMS;
- Georeferenced images of mosaiced SSS and MBBS along with georeferenced images of gridded MBES and Mag. data for the ECC, surveyed by N-Sea (N-Sea, 2023); and
- Georeferenced images of mosaiced SSS and MBBS, *.xyz* files of MBES data and *.csv* files of Mag. data for the array area, surveyed by Fugro (2022).

The provided reports were reviewed to extract offshore archaeology and cultural heritage baseline information on any wrecks or possible wreck debris within the study area, whether identified during the surveys or previously identified by the UKHO and NMS. Nine such features were identified, assigned a unique dentification number and collated in a gazetteer for the purposes of defining the EIAR baseline (see Appendix 18.3). The positions of each feature were investigated in the provided data by viewing the images in ArcMap GIS and the dimensions and descriptions of anomalies observed were added to the gazetteer. Additional anomalies observed in the data which may be related to the features of interest were also added to the gazetteer, outlined in Section 18.3.2.

Where positional inaccuracies have been encountered in provided technical reports based on documentary sources such as UKHO positions, these have been resolved in the dataset presented in this EIAR chapter. Coordinates from wreck datasets have been converted and reprojected and where possible integrated with geophysical datasets to provide a consistent and consolidated dataset for receptors reported in this EIAR.

18.2.6.2 Geophysical data quality and limitations

The majority of the data were provided as georeferenced images rather than geophysical sensor datasets. The data consulted were focussed to areas of the seabed to contextualise features previously identified in project-specific technical reports provided for the EIAR baseline from Foreshore Licence-related works. The exceptions being the Magnetometer and MBES data for the array area, which were used to produce georeferenced images comparable to those provided for the datasets. As such, it was not possible to measure the height of any anomalies, only the length and width. It was also not possible to measure the amplitude of any magnetic anomalies but only to say whether there appeared to be a response in the data or not.

The datasets were individually assessed for quality and their suitability for archaeological purposes, based on just the sections of data used for the assessment. Data quality was rated using the following criteria (Table 18.3) developed by Wessex Archaeology.

Table 18.3: Criteria for assigning data quality rating

Data quality	Description
Good	Data which are clear and unaffected or only slightly affected by weather conditions, sea state, background noise or data artefacts. Seabed datasets are suitable for the interpretation of upstanding and partially buried wrecks, debris fields, and small individual anomalies. The structure of wrecks is clear, allowing assessments on wreck condition to be made. Subtle reflectors are clear within SBP data. These data provide the highest probability that anomalies of archaeological potential will be identified.
Average	Data which are moderately affected by weather conditions, sea state and noise. Seabed datasets are suitable for the identification of upstanding and partially buried wrecks, the larger elements of debris fields and dispersed sites, and larger individual anomalies. Dispersed and/or partially buried wrecks may be difficult to identify. Interpretation of continuous reflectors in SBP data is problematic. These data are not considered to be detrimentally affected to a significant degree.
Below average	Data which are affected by weather conditions, sea state and noise to a significant degree. Seabed datasets are suitable for the identification of relatively intact, upstanding wrecks and large individual anomalies. Dispersed and/or partially buried wrecks, or small isolated anomalies may not be clearly resolved. Small palaeogeographic features, or internal structure may not be resolved in SBP data.
Variable	This category contains datasets where the individual lines range in quality. Confidence of interpretation is subsequently likely to vary within the study area.

ECC

Within the ECC, the SSS data were provided as a high frequency mosaic with the data generally acquired at a line spacing of 40m, crossline spacing of 1km and a range of 50m. The line spacing in the nearshore area was reduced to 20m. The mosaic was provided at a resolution of 0.1m and was of ‘good’ quality and sufficient for small feature identification. However, the heights of features could not be measured.

The MBES data were provided as a 0.5m resolution bathymetry raster. However, as a single band raster the high/low values were required to be adjusted in order to identify any features within the ECC and low-lying features may have been missed. The data quality is sufficient for the identification of features over 1m in size so long as they are of sufficient height or depth to stand out from the background. The data quality is therefore rated as ‘average’. It was not possible to measure heights or depths of features in this dataset.

The MBBS data were provided as a 0.5m resolution backscatter single band colour raster, with a maximum line spacing of 40m. The resolution is sufficient for the identification of features over 1m in size. The quality of the data is rated as ‘average’.

The Magnetometer data were supplied as a single-band colour raster image with a variable line spacing of approximately 20m in the nearshore area and approximately 40m further offshore. The image resolution of 0.5 x 0.5m was suitable. However, it was not possible to measure the amplitudes of anomalies and therefore this dataset is rated as ‘below average’.

Array area

For the array area, the SSS data were provided as numerous high frequency RGB mosaic files with a 0.1m resolution. The data were acquired with a 500m line spacing.

This resulted in the majority of the array area not being covered by this dataset. However, the quality of the data viewed for the assessment of one wreck could be rated as ‘Good’ as the quality was sufficient for archaeological interpretation and small features could be identified. However, the whole wreck of the *Downshire* **7009** was not covered and the lack of data coverage leads to an overall rating of ‘below average’ for the dataset.

The MBES data were provided as numerous xyz files with a resolution of 1m which were loaded into Fledermaus (part of a suite of industry standard software that enables the 3D visualisation of xyz point cloud data and the production of 3D gridded surfaces) and subsequently exported as a geotiff. This MBES data was sufficient for the identification of features over 2m in size. The quality of the data is rated as ‘average’. It was not possible to measure heights or depths of features in this dataset.

The MBBS data was supplied as a 1m resolution backscatter RGB raster acquired by Fugro and re-rendered by GDG to enhance interpretability. The resolution is sufficient for the identification of features over 2m in size and the quality of the data is rated as 'average'.

The Magnetometer data were provided as processed csv files which were then generated into a 1m resolution gridded RGB raster. Line spacing was approximately 500m and the majority of the array area is therefore not considered to be covered by this dataset. It was also not possible to measure the amplitudes of anomalies. This dataset is rated as 'below average'.

Geophysical survey data coverage considered for the array area is focussed on surveyed corridors and coverage and identification of receptors has not currently extended beyond those corridors. The contributing Foreshore Licence-related archaeological technical assessments (see Section 18.2.4.4) have been confirmed as acceptable to inform for the offshore archaeology EIAR baseline for the proposed development by the NMS via Consultation (Appendix 1.2).

For the purposes of this EIAR chapter further review of geophysical datasets at the location of known or potential maritime assets identified in the Foreshore Licence-related reports and desk-based review has been undertaken. This process has resolved the maritime receptors considered in this chapter and illustrated in the wreck sheets within Appendix 18.2.

18.2.7 Methodology for Assessment of Effects

EIA significance criteria for offshore archaeology and cultural heritage follows Environmental Protection Agency (EPA) guidance:

- EPA (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports.

The criteria for determining the sensitivity of the receiving environment and the magnitude of impacts for the offshore archaeology and cultural heritage assessment are defined in Table 18.4 and Table 18.5 respectively. A matrix was used for the determination of significance in EIA terms (Table 18.6). The combination of the magnitude of the predicted impact with the sensitivity of the receptor determines the assessment of significance of effect.

The significance of likely significant effects has been evaluated using a systematic approach, based upon identification of the importance/value of receptors and their sensitivity to the proposed development activity, together with the predicted magnitude of the impact.

The terms used to define receptor sensitivity and magnitude of impact are based on a range of sources, particularly Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage (now Historic England) 2008) and Ships and Boats: Prehistory to Present – Designation Selection Guide (English Heritage (now Historic England) 2012). These criteria have been adopted in order to implement a specific methodology for offshore archaeology and cultural heritage.

18.2.7.1 Sensitivity criteria

For each impact, the assessment identifies receptors sensitive to that impact and implements a systematic approach to understanding the impact pathways and the magnitude of impacts on given receptors.

Receptor sensitivity is determined by considering a combination of value, tolerance, adaptability and recoverability.

Offshore archaeology and cultural heritage receptors cannot typically adapt, tolerate, or recover from physical impacts resulting in material damage or loss caused by development activities.

Consequently, the sensitivity of each receptor is predominantly quantified only by its value.

Within this chapter of the EIAR, value is weighed by consideration of the potential for the receptor to demonstrate the following value criteria:

- Evidential value – deriving from the potential of a place to yield evidence about past human activity;
- Historical value – deriving from the ways in which past people, events and aspects of life can be connected through a place to the present. It tends to be illustrative or associative;

- Aesthetic value – deriving from the ways in which people draw sensory and intellectual stimulation from a place; and
- Communal value – deriving from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values but tend to have additional and specific aspects.

With regards to assessing the value of shipwrecks, no Ireland-specific guidance currently exists and a best practice approach commonly applied to similar major marine developments in England and Scotland is employed here as a demonstrated and robust approach to assessing a receptor in terms of its value (English Heritage (now Historic England) 2012):

- Period;
- Rarity;
- Documentation;
- Group value (for example, if part of a group of sites, or a specific type of vessel);
- Survival/condition; and
- Potential (for example, the potential of the shipwreck to contribute new knowledge).

The definitions of receptor sensitivity for the purpose of the offshore archaeology and cultural heritage assessment are provided in Table 18.4.

Table 18.4: Sensitivity of the receiving environment

Receptor sensitivity	Definition
High	Best known, only example or above average example and/or significant or high potential to contribute to knowledge and understanding and/or outreach. Receptors with a demonstrable international or national dimension to their importance are likely to fall within this category: • Wrecked ships and aircraft with an international dimension to their importance and any wreck protected by national law (i.e. all wrecks over 100 years old); and • Known submerged prehistoric sites and landscapes with the confirmed presence of largely in situ artefactual material, or palaeogeographic features with demonstrable potential to include artefactual and/or palaeoenvironmental material, possibly as part of a prehistoric site or landscape.
Medium	Average example and/or moderate potential to contribute to knowledge and understanding and/or community engagement: Includes wrecks of ships and aircraft that have moderate potential based on a formal assessment of their importance in terms of build, use, loss, survival, and investigation; and Prehistoric deposits with moderate potential to contribute to an understanding of the palaeoenvironment.
Low	Below average example and/or low potential to contribute to knowledge and understanding and/or community engagement: • Includes wrecks of ships and aircraft that have low potential based on a formal assessment of their importance in terms of build, use, loss, survival, and investigation; and • Prehistoric deposits with low potential to contribute to an understanding of the palaeoenvironment.
Negligible	Poor example and/or little or no potential to contribute to knowledge and understanding and/or community engagement. Receptor with little or no surviving archaeological interest.

Where the identity of a wreck or receptor is unknown but it is recognised that it has archaeological potential it will be allotted a high value and sensitivity as a precautionary measure.

18.2.7.2 Magnitude of impact criteria

The scale or magnitude of potential impacts depends on the degree and extent to which the proposed development activities may change the environment, which usually varies according to project phase (i.e. construction, operation and decommissioning).

Factors that have been considered to determine the magnitude of potential impacts include:

- Area of influence/spatial extent;
- Level of deviation from baseline conditions;
- Frequency of impact;
- Duration of impact; and
- Reversibility of impact.

The criteria for defining magnitude of impact for the purpose of the offshore archaeology and cultural heritage assessment are provided in Table 18.5.

Table 18.5: Magnitude of the impact

Magnitude	Definition
High	Complete or comprehensive physical damage or changes to the character of the receptor.
Medium	Considerable changes that affect the character of the receptor, resulting in considerable physical damage.
Low	Minor change that partially affects the character of the receptor, resulting in some physical damage.
Negligible	Very minor or negligible change to the character of the receptor, with no or negligible physical damage leading to an imperceptible change to the baseline.

18.2.7.3 Defining the significance of effect

The significance of effect associated with an impact will be dependent upon the sensitivity of the receptor and the magnitude of the impact. The assessment methodology for determining the significance of likely significant effects is described in Table 18.6. Effects defined as significant or profound are considered significant in EIA terms. An effect that has a significance of moderate, slight, not significant or imperceptible is not considered to be significant in EIA terms.

Table 18.6: Significance of likely significant effects upon offshore archaeology and cultural heritage

Sensitivity of Receptor	Magnitude of impact			
	High	Medium	Low	Negligible
High	Profound	Significant	Significant	Not significant
Medium	Significant	Moderate	Slight	Not significant
Low	Slight	Slight	Not significant	Imperceptible
Negligible	Not significant	Not significant	Imperceptible	Imperceptible

Where relevant, mitigation measures that are incorporated as part of the proposed development design process and/or can be considered to be industry standard practice (referred to as 'embedded mitigation') are considered throughout the chapter and are reflected in the outcome of the assessment of effects, described in Section 18.5. Additional mitigation measures that are not embedded and are considered as part of the residual effects assessment are described separately (Section 18.6).

18.3 Baseline Environment

18.3.1 Introduction

The following sections provide a description of the baseline conditions for offshore archaeology and cultural heritage. The baseline resource of offshore archaeology and cultural heritage, which includes known wrecks and obstructions, identified geophysical receptors, the potential for further maritime and aviation archaeological receptors, potential seabed prehistory and intertidal heritage receptors is presented in Appendices 18.3–18.6 and illustrated in Figures 18.2–5 and Sheets 1–4 of Appendix 18.2.

18.3.2 Receiving Environment

18.3.2.1 Seabed Prehistory

The appraisal of geophysical data within the study area resulted in the identification of a total of three features of palaeogeographical interest, all within the array area. Full details can be found in Appendix 18.1 and illustrated in Figure 18.2 of this EIAR.

These are summarised as follows:

- A total of three features, including two channel complexes (70001 and 70004) and one distinct channel (70003) were assigned a P1 archaeological rating (feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material), within the array area.
- An additional channel complex (70002) was present within the northeastern extent of the geophysical survey area (outside of the offshore development area and study area). It is mentioned here for additional context of new palaeogeographical knowledge provided by the proposed development but not taken forward as a receptor as located beyond the spatial extent of impact pathways identified.

The array area contains extensive sedimentary stratigraphy reflecting the development of a broad post-glacial palaeolandscape through significant phases of palaeo-channel formation, coastal-deltaic development until ultimately being inundated by rising sea levels. The unit with the greatest archaeological interest was observed to be Unit 4a; SL2 of the Surface Sands formation. Relative Sea Level (RSL) data from deeper water locations and corresponding understanding of the archaeological potential of these palaeolandscapes, offshore Ireland, are rare, very poorly constrained and identified as a national priority for study.

Table 18.7 summarises the potential for seabed prehistory assets and their respective value based on the criteria described in Table 18.6.

Table 18.7: Value of seabed prehistory assets

Asset type	Definition	Value
Potential in situ prehistoric sites	Primary context features and associated artefacts and their physical setting (if found).	High
	Known submerged prehistoric sites and landscape features with the demonstrable potential to include artefactual material.	
Potential submerged landscape features	Other known submerged palaeolandscape features and deposits likely to date to periods of prehistoric archaeological interest with the potential to contain in situ material.	High
Potential derived prehistoric finds	Isolated discoveries of prehistoric archaeological material discovered within secondary contexts.	Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material.	Low
	Palaeoenvironmental material associated with specific palaeolandscape features or archaeological material.	High

18.3.2.2 Seabed features: maritime (array area)

The archaeological assessment for the array area by ADCO (ADCO 2022) identified a total of one shipwreck location, the location given for the SS *Downshire* (WA7009) within the array area (Figure 18.3). As a wreck of over 100 years in age this is automatically subject to statutory protection.

The wreck SS *Downshire* (WA7009) is considered as being of high value. The site was identified in the MBBS, MBES and SSS data as a debris field measuring 94 x 24.3m, with several large irregular sections of debris near the centre of the field.

This wreck is charted by the UKHO (7046) and has an associated NMS record (W01996) which report the wreck as being in three parts, with the remains almost buried.

The ship was an iron hulled steam collier built in 1905 sailing from Whitehaven to Dublin with a cargo of coal when it was captured by UB-64 and sunk by gunfire. Full details can be found in Wreck Sheet 4 of Appendix 18.2.

18.3.2.3 Seabed features: maritime (ECC)

The archaeological assessment for the ECC by ADCO (ADCO 2023b) alongside the updated desk-based study identified a total of nine possible wreck or debris locations within the ECC and a further four wreck locations within the wider study area (Figure 18.3). The assessment has discriminated these as follows:

- Nine high value anomalies, all within the ECC;
- One high value anomaly, within the wider study area, outside the ECC area but within 150m of it; and
- Three high value anomalies, within the wider study area and outside the ECC by more than 150m.

Wreck sheets were then generated for the three possible wrecks (WA7002, WA7006 /WA7010/ WA7011 and WA7007/ WA7012) within the ECC. While the recorded feature of 7008 (NMS: W00523) is included within the ECC, no trace of it was discovered in the geophysical data across any of the sensors, despite the UKHO record describing it as a sizeable quantity of metal distributed on the seabed.

The age of these anomalies has not been identified as they are not named wrecks; however should they prove to be wreck material of over 100 years in age then they would have statutory protection similar to the wreck of the *Downshire*.

18.3.2.4 Other potential maritime features in the ECC

An anomaly WA7001 identified in the MBES dataset as a mound within a depression was located towards the end of a suspected trawl scar. A magnetic response was associated with this anomaly. The ADCO assessment suggested this could either be lost trawl gear or material associated with the *Belle Hill* wreck, which was located 470m to the WNW.

Three debris fields were also visible in the SSS dataset located within the ECC and were identified as potential wrecks by ADCO (ADCO 2023b). These anomalies have no corresponding UKHO or NMS record and so it is unclear whether they are wrecks or areas of debris, but they have been discriminated as high value as a precaution.

WA7002 measures 17.8 x 13.7m and is visible in the SSS dataset as a debris field with numerous dark reflectors, and within the MBES dataset as an oval depression indicating a possible scour surrounding three mounds. It also had an associated response on multiple lines of Mag. data, indicating the presence of ferrous material. Full details can be found in Wreck Sheet 1 of Appendix 18.2.

WA7006 measures 18.5 x 10.5m and is visible in the SSS dataset as a debris field comprising multiple numerous angular and elongate dark reflectors.

It was visible in the MBES dataset as an oval depression which may be a scour containing several small mounds along the south-eastern side. It also had a magnetic response within nearby lines of Mag. data. Full details can be found in Wreck Sheet 2 of Appendix 18.2.

WA7007 is noted to be a mound with possible associated scour from the MBES dataset. The SSS dataset shows a poorly defined seabed disturbance of considerable height with a large distinct dark reflector in the centre. Mag. anomalies suggest the presence of ferrous material, which would suggest an anthropogenic origin. The ADCO assessment suggests this might be related to a UKHO record located 46m to the north-east (UKHO 7057, identified in this assessment as WA70013) which was listed as a known obstruction in 1977 made up of a substantial quantity of metal, probably iron. Full details can be found in Wreck Sheet 3 of Appendix 18.2.

During the development of the wreck sheets for these debris fields, three further anomalies were identified: two within the SSS dataset close to the debris field of WA7006 and one close to WA7007. WA7010 was noted 12.7m to the east of WA7006 as a distinct irregularly shaped area of variable reflectivity which could represent multiple objects close together. It was also observed in the MBES data as an indistinct depression.

A second indistinct feature WA7011 was located in the SSS dataset 5m to the south of WA7006 as an indistinct dark reflector with an adjacent dark reflector. It wasn't visible in the other datasets, possibly due to masking in the case of the Mag. data. These may be additional pieces of wreck or debris related to the debris field and possible wreck at WA7006.

A small dark reflector WA7012 was identified in the SSS dataset 7.5m south of the western end of the mound feature at WA7007. This was interpreted as either a possible natural feature or possible debris related to this anomaly.

Two records which did not have geophysical anomalies associated with them were present within the ECC. These represent a UKHO record (UKHO 7057) and an NMS record (W00523) which may be for the same feature but are c.75m apart and so have been allocated separate entries (respectively WA7008 and WA7013) in line with the precautionary methodology of impact assessment. As noted above the ADCO geophysical assessment found no geophysical anomalies at these locations and has suggested that they may relate to a newly identified anomaly 470m to the WSW. The location of the UKHO record was reported using DECCA navigator equipment which was not as accurate as modern navigational equipment. Despite no geophysical anomaly being identified at these locations they have been kept in for impact assessment as a precaution.

18.3.2.5 Wider study area around ECC

The wreck of the *Belle Hill* (WA7000; NMS W00543- also known as *Bell Hill*) is located immediately north of the ECC close to the landfall. It was an 800-ton iron barque built in 1866 and was wrecked at Bremore in February 1875 while on passage from Liverpool to Valparaiso with a general cargo. 24 of the 25 crew were drowned, and a cairn on the foreshore at Bremore is known as Sailor's Grave in memorial of them (WA1001, discussed in the intertidal section). While this receptor is outside the ECC, it is within 150m of it (and within the study area) and is over 100 years in age so has statutory protection. Additional intertidal and shallow water marine geophysical survey has been completed to cover the recorded position of the *Belle Hill* and infill the nearshore section of the ECC, so there is a possibility of extending any assigned AEZ to include the results of this survey. However the data was unavailable at the point of writing and so will not be integrated into this chapter.

Two iron barges (WA7003 and WA7004) outside the southern extent of the ECC but within the study area have been identified by previous surveys up to 2015 (unrelated to the proposed development) in UKHO records (6952 and 69594 respectively) and have NMS records (W00471 and W00472 respectively). They are listed as being upright and intact, lying side by side E–W on the seabed within scour pockets in 19m of water. Each wreck is around 30m long by 8m wide and up to 4m high.

A third wreck, WA7005, is located outside the southern extent of the ECC but within the study area has been mapped on the NMS via the National Seabed Survey. It is described as measuring 16 x 5 x 2m and lying at a depth of -21m.

18.3.2.6 Maritime archaeological potential

The assessment of potential for the discovery of shipwreck and shipwreck-derived material within the study area draws on the results of the geophysical survey and desk-based research combined with further research of the wider area.

The survey design within the array area includes areas of unsurveyed seabed, therefore, there is high potential for unknown offshore archaeology and cultural heritage assets within the array area.

In areas of the array area and ECC that have been surveyed, where data quality is lower; or, smaller partially buried and otherwise indistinct features are preserved on or in the seabed, there is potential for unidentified offshore archaeology and cultural heritage assets.

The wreck of the *Belle Hill* (WA7000) was partially salvaged, and the remains then appear to have been dispersed, although reports note that significant portions of the wreck were visible in the 1950s and 1960s (Deery & Goucher 2008). There is therefore a high potential for material relating to the wreck, whether cargo or fragments of the ship, to be located within a wide area around the wreck location, potentially extending into the ECC. It is noted that there is a gap in information between the extents of the archaeologically assessed ECC marine geophysical survey (ADCO 2023b) and the intertidal survey area (ADCO 2023a), which is currently being surveyed. The results of this updated survey will be archaeologically assessed.

The nearshore elements of the ECC geophysical surveys showed an increase in magnetometry anomalies which have been assessed (ADCO 2023b) as likely to be related to the local geology, but the report does note that these may equally relate to wreck material from the *Belle Hill*. There is therefore also potential for currently unidentified wreck material within the nearshore section of the ECC.

More generally there is potential for discoveries of maritime craft from the Mesolithic to the modern period (Brady 2008, 13–47; Bolton 2012). There is little direct archaeological evidence of ships and boats from earlier periods, but there is indirect evidence for seafaring that includes the exploitation of marine resources and seaborne trade. Post-medieval and modern wrecks, as they were generally made of more substantial material, are more likely to have been discovered through surveys, and thus recorded in the archaeological record. However, there is still potential for discovery of previously unrecorded wreck sites, particularly of wooden wrecks, broken up wrecks or partially buried wrecks that are more difficult to detect through geophysical survey.

18.3.2.7 Navigational hazards

The surrounding coasts and waters present a range of navigational hazards relevant to historic maritime activity. The rock hazards around Skerries, including Rockabill at the southern end of the coast facing the proposed development have the highest potential; while the remainder of the wide curve between Skerries and Clogherhead has few hazards beyond ships being blown on to the coastline. Unlike Dublin Bay to the south there are no extensive offshore sand banks, which pose the greatest risk to shipping. The Recorded Losses do still suggest that Drogheda Bar was a significant navigational hazard for vessels entering and leaving the Boyne, and hazards such as the Cardy Rocks off Bremore were the cause of multiple wrecking events. The seafloor within the study area is mostly comprised of finer grained sediments (more suited to the preservation of archaeological material than coarser grained deposits such as gravels), but also has some small areas of rock, particularly off the headlands at the north and south of the coastline.

The study area falls within an area of significant historic shipping and navigation activity. These include the passage of merchant vessels, recreational craft, military vessels, and vessels engaged on specialist operations. This would include both regional Irish Sea trade and movement, as well as ships beginning or completing longer voyages from the major ports of Dublin, Liverpool and Manchester.

18.3.2.8 Recorded losses

Recorded Losses are records for ships or aircraft that are known to have wrecked or crashed offshore, but for which the exact locations are not known. These records relate to vessels reportedly lost or for which no physical wreck remains have ever been identified.

Many vessels were lost without a record being made, and sometimes even the records that were created have since been lost. Examining the recorded losses discussed above provides an indication to the potential for further discoveries, relevant to the consideration of potential cultural heritage receptors.

Recorded Losses can be considered as an indication of the potential for archaeological maritime remains to exist within the study area and the type and number of wrecks that could be present. There will be a bias in these records towards vessels dating to the post-medieval period and later. While this to some extent could represent a significant increase in shipping during the post medieval period, it also reflects the fact that reports of shipwreck events in Ireland were not systematically recorded until the 18th century. There will also be a bias towards vessels that sank in inshore waters.

The WIID dataset contains over 14,000 Recorded Losses without positional data. These are records for which although a vessel (or vessels) is known to have been lost in the general area, no material has been encountered on the seabed at the recorded location.

This data set was searched using a number of key terms relating to the location of the proposed development. These included the names of towns, harbours, sandbanks, bays and islands to which recorded losses information may be referenced against. Not all of these returned results, and some were multiples with other named places. These terms in alphabetical order are:

- Ardgillan;
- Balbriggan;
- Baltray;
- Bettystown:
- Boyne;
- Braymore/Bremore;
- Clogherhead/Clogher Head;
- Coney Hill;
- Drogheda;
- Gormanstown/Gormanston;
- Inse Bay/Inse;
- Lambay;
- Laytown;
- Nanny;
- Port Oriel;
- Red Island;
- Rockabill;
- Rush;
- Skerries;
- St Patrick's Island;
- Termonfeckin; and
- Tubbertoby.

The Underwater Archaeological Impact Assessment completed by ADCO (ADCO 2021) discussed the Recorded Losses within the Maritime Area Consent (MAC) boundary[1] which extended further south. Records within wider Co. Dublin south of Skerries such as Lambay Island and Rush were checked and then omitted unless the direction noted was towards the proposed development. Losses recorded in other waters that were listed as having originated or been owned in one of the searched places e.g. Drogheda were omitted, as were those that were recorded as being lost between Drogheda and other cities or places such as Spain and the United States. Any records listed as being related to UKHO records were also removed. An attempt to remove multiples within the results was made, however there are some which remain as the information in each entry was slightly different. This left 527 individual records of vessels and two aircraft. A full gazetteer of these has been included in Appendix 18.3. This is not meant to represent a full list of every vessel that has possibly wrecked in the study area, but rather to give a picture of the types of vessels that have wrecked in the area through time, in order to highlight the potential for further possible discoveries.

The losses generally represent post-medieval and modern vessels. In general, Recorded Losses paint a vibrant picture of the types of voyages being undertaken around the east coast of Ireland. The types of vessels highlight the wide range of maritime activities in the study area over time, including national and international trade and the fishing industry.

Pre-1800 Dublin, located south of the study area, was a key port in the post medieval period, particularly for trade across the Irish Sea (Brady 2008, 40–1) to Welsh, Scottish and northwestern English ports. The port of Drogheda, upstream on the Boyne, was also an important port for fishing and for trade. Drogheda and Skerries returned the most entries in the searches, with Drogheda Bar being a location of many strandings.

The 19th century saw a rapid development of maritime technology, with ships beginning to be constructed with iron and steel, and the development of stream power, first with paddles, and then with screw propulsion.

The 20th century saw the development of the first motor vessels, but sailing vessels and steam vessels are still more heavily represented in the recorded losses. A number of post-1945 vessels were also present within the search results. Table 18.8 shows the distribution of these documented losses according to the date of loss for those records.

Table 18.8: Recorded Losses – summary by date

Date	Number of records of ships	Number of records of aircraft
Pre 1500 AD	0	
1500 to 1799	57	
1800 to 1899	392	
1900 to 1945	51	2

[1] The MAC is a State consent awarded in 2022 which allows the Developer the right to occupy a part of the maritime area and the ability to subsequently apply for development consent within that maritime area.

Date	Number of records of ships	Number of records of aircraft
Post – 1946	17	
Unknown	10	
Total	527	2

18.3.2.9 Overview of potential

There is potential for the presence of archaeological material of maritime nature spanning from the Mesolithic period to the present day within the study area. The key periods of potential are summarised in Table 18.9 below.

Table 18.9: Overview of potential for maritime archaeology

Period	Summary
Pre-1500 AD	Low potential for material associated with prehistoric maritime activities. Prehistoric maritime activities include coastal travel, fishing and the exploitation of other marine and coastal resources. Vessels of this period include rafts, hide covered watercraft and log boats.
	Low potential for material associated with later prehistoric maritime activities, including seaworthy watercraft suitable for overseas voyages to facilitate trade and the exploitation of deep-water resources. Such remains are likely to comprise larger boat types, including those representing new technologies such as the Bronze Age sewn plank boats which are associated with a growing scale of seafaring activities.
	Low potential for material of Roman date, associated with the expansion and diversification of trade with the Continent and in Irish Sea. Watercraft of this period, where present, may be representative of a distinct shipbuilding tradition known as 'Romano-Celtic' shipbuilding, often considered to represent a fusion of Roman and northern European methods.
	Low potential for material associated with coastal and seafaring activity in the Early Medieval Period, associated with the renewed expansion of trade routes and Norse invasion and migration. Vessels of this period may be representative of new shipbuilding traditions.
	Low potential for material associated with medieval maritime activity, including that associated with increasing trade between Ireland, Britain and wider Europe, the development of established ports around the Irish Sea and the expansion of fishing fleets and the herring industry. Vessels of this period are representative of a shipbuilding industry which encompassed a wide range of vessel types (comprising both larger ships and vernacular boats). Such wrecks may also be representative of new technologies (e.g. the use of flush-laid strakes in construction), developments in propulsion, the development of reliable navigation techniques and the use of ordnance.
1500 to 1800	Medium potential for post-medieval shipwrecks representative of continuing technological advances in the construction, fitting and arming of ships, and in navigation, sailing and steering techniques. Vessels of this period continued to variously represent both the clinker techniques and construction utilising the flush-laid strakes technique.
	Medium potential for post-medieval shipwrecks associated with the expansion of transoceanic communications and the opening up of the New World.
	Medium potential for post-medieval shipwrecks associated with the establishment of various national navies (e.g. the British Royal Navy) and the increasing scale of battles at sea.
	Medium potential for post-medieval shipwrecks associated with continuing local trade and marine exploitation including the transport of goods associated with the wider social changes e.g. agricultural revolution.
1800 to 1913	Higher potential for the discovery of shipwrecks associated with the introduction of iron and later steel in shipbuilding techniques. Such vessels may also be representative of other fundamental changes associated with the industrial revolution, particularly with regards to propulsion and the emergence of steam propulsion and the increasing use of paddle and screw propelled vessels.
	Higher potential for the discovery of shipwrecks demonstrating a diverse array of vernacular boat types evolved for use in specific environments.
	Higher potential for wrecks associated with large scale worldwide trade, the fishing industry or coastal maritime activity including marine exploitation.
1914 to 1945	Higher potential for the discovery of shipwrecks associated with the two world wars including both naval vessels and merchant ships. Wrecks of this period may also be associated with the increased shipping responding to the demand to fulfil military requirements.

Period	Summary
	A large number of vessels dating to this period were lost as a result of military action.
Post- 1945	Medium potential for wrecks associated with a wide range of maritime activities, including military, commerce, fishing and leisure. Although ships and boats of this period are more numerous, loses decline due to increased safety coupled with the absence of any major hostilities. Location of wrecks is more likely to be known due to better reporting. Vessels dating to this period are predominantly lost as a result of any number of isolated or interrelated factors including human error, adverse weather conditions, collision with other vessels or navigational hazards or mechanical faults.

18.3.2.10 Aviation archaeological baseline and potential

Marine aviation archaeology receptors comprise the remains or associated remains of military and civilian aircraft that have been lost at sea.

Ireland is rich in First World War aviation heritage, including airfields, landing grounds, and training facilities. In some cases, these sites are still visible in the landscape, in other cases they have disappeared. In total there were 23 aviation sites established in Ireland. The operators of these sites were the Royal Flying Corps (RFC), Royal Navy Air Service (RNAS) and US Navy and Air Service (USNAS) (Warner and Cromie, 2012).

The assessment of potential for the discovery of aircraft crash sites and aircraft derived material within the study area draws on the results of the geophysical survey and desk-based research combined with further research of the wider area.

There are no positively located aircraft crash sites recorded within the study area, however there is potential for the discovery of previously unknown aircraft material.

18.3.2.11 Recorded losses

There are two recorded losses of aircraft within the study area, which do not have known locations - see Table 18.10. The first was the loss of a British aircraft off Laytown in March 1941. The location of this crash is approximate, but the location given is within 1 mile of the coast. This location could be within or outside the study area. The exact type of aircraft is also unknown.

A second recorded loss of an aircraft is listed c. 20 miles east of Skerries. No further information is available on this loss other than it is recorded as a trawler snag. As above this location could be either within or outside the study area.

Table 18.10: Recorded Losses - aircraft

Wreck No	Classification	Place of Loss	Year of Loss
W10848	Aircraft (British)	Off Laytown (c. 1 mile)	1941
W9806	Aircraft	Off Meath (c. 20 miles E of Skerries)	Unknown but 20th Century. Listed as a trawler snag.

18.3.2.12 Overview of potential

There is potential for the presence of aviation material dating from the early 20th century until more recent times, with a concentration dating to the World Wars and in particular to the Second World War (Wessex Archaeology 2008a). Discoveries may occur anywhere within the study area. Aircraft crash sites are also difficult to identify through archaeological assessments of geophysical survey, although past experience indicates material from the site, such as engines or other material may be recorded as small obstructions or anomalies.

The key periods of aviation potential that may be uncovered within the study area are summarised in Table 18.11.

Table 18.11: Overview of potential for aviation archaeology

Period	Summary
Pre- 1939	Minimum potential for material associated with the early development of aircraft. Aircraft of this period may represent early construction techniques (e.g. those constructed of canvas covered wooden frames) or may be associated with the mass-production of fixed wing aircraft in large numbers during First World War.
	Minimum potential for material associated with the development of civil aviation during the 1920s and 1930s, associated with the expansion of civilian flight from the British Isles to a number of European and worldwide destinations.
1939 to 1945	High potential for Second World War aviation remains, despite the neutrality of the Ireland during Second World War. Aircraft of this period are likely to be representative of technological innovations propelled by the necessities of war which extended the reliability and range of aircraft.
Post- 1945	Medium potential for aviation remains associated with military activities dominated by the Cold War, the evolution of commercial travel and recreational flying and the intensification of offshore industry (including helicopter remains). Aircraft of this period may be representative of advances in aerospace engineering and the development of the jet engine. Location of aircraft wrecks is more likely to be known due to better reporting.

18.3.2.13 Intertidal receptors

Seven intertidal receptors have been identified (ADCO 2023a). These include three receptors to the north of the ECC in the study area and four receptors that lie within the landfall of the ECC (Figure 18.4).

Table 18.12: Intertidal receptors

Receptor No	ETRS89 UTM30N Easting	ETRS89 UTM30N Northing	Description
ADCO 01	285998	5901058	Look-out post No. 4. Concrete base for a coastal defence lookout post.
ADCO 02	285968	5901032	Debris: Ceramic sherd. Single sherd of ceramic within intertidal deposits.
ADCO 03	286121	5901164	Debris: Metal elements. Sections of iron bar or banding. Possible wreck material.
ADCO 04	286112	5901157	Debris: brass tap. Possible wreck material.
ADCO 05	285943	5901010	Memorial with small wooden cross dated 2018.
ADCO 06	285967	5901031	Stone culvert.
WA1001	285954	5901020	Sailor's grave/Belle Hill cairn. Cairn of stones on foreshore commemorating shipwreck victims.

The receptors within the ECC landfall include two pieces of probable wreck debris (ADCO 03 and ADCO 04), potentially either from the *Belle Hill* or from one of the many Recorded Losses wrecked on the Cardy Rocks. The remaining two receptors are located on the landward edge of the intertidal zone and include a stone culvert (ADCO 06) thought to relate to the construction of the Great Northern Railway, and a small memorial constructed in 2018 (ADCO 05) (Figure 18.4).

The small stone cairn known as the Sailor's Grave (WA1001), located on the northern boundary of the ECC, is noted as being built in remembrance of those lost on the *Belle Hill*, with six bodies being recovered at Bremore and buried at Balrothery cemetery. The Fingal County Historic Landscape Characterisation (Deery & Goucher 2008) suggests that the remaining bodies were washed up on the Isle of Man or the Cumbrian coastline in north-west England, and so it is likely that the cairn represents a memorial rather than the location of any actual graves; however this cannot be confirmed.

As noted within the Intertidal report the quay at Newhaven is located to the north of the ECC (ADCO 2023a). This pier (DU002-0015) is thought to date to the 16th century and is made up of a stone rubble pier running approximately 62m ENE from the east-facing coastline. This pier served the small settlement of Newhaven which was built as a fishing settlement after 1562 by James and Margaret Barnewell (Deery & Goucher 2008). The location of this site demonstrates the utilisation of this section of coastline by small vessels, during this period.

There is therefore the potential for small vessels to have either been wrecked or disposed of within the vicinity of the site. A full site record of the quay wall was made during the intertidal survey (ADCO 2023a) and it is also noted within Volume 4, Chapter 25: Onshore Archaeological, Architectural and Cultural Heritage.

Other foreshore features noted in the previous reports include prehistoric remains on Bremore Point to the north of the ECC and remains of the 16th/17th settlement of Newhaven which includes field systems, structures and a small church and graveyard. These demonstrate the utilisation of the coastline in both prehistory and the post-medieval periods, and therefore the potential for related material within the intertidal zone.

Potential for further material to be exposed along the intertidal zone is highlighted by the record relating to the *Belle Hill* wreck, which notes that the wreck was heavily salvaged and disturbed. While the original position of the wreck is to the north of the ECC the salvage activity may have spread related debris across the area of the ECC to the south of the wreck site. A programme of geophysical survey is currently being conducted, for which archaeological assessment will be completed to check for this potential.

18.4 Characteristics of the Proposed Development

This section outlines the characteristics of the proposed development that are relevant to the identification and assessment of likely significant effects on offshore archaeology and cultural heritage during each phase of the proposed development. In this chapter this is limited to activities and infrastructure occurring in the offshore environment and it considers both Project Option 1 and Project Option 2 (the key characteristics of which are provided in Table 18.13 and are detailed in full in the Offshore Description Chapter).

Table 18.13: Key characteristics of Project Option 1 and Project Option 2

Key Offshore Characteristics	Project Option 1	Project Option 2
Array area	88.5km^2	88.5km^2
ECC	36.45km^2	36.45km^2
Landfall	One landfall site, immediately south of Bremore Point, which includes two subtidal exit pits within the ECC	One landfall site, immediately south of Bremore Point, which includes two subtidal exit pits within the ECC
Wind Turbine Generator (WTG)	49 WTGs with 250m rotor diameter	35 WTGs with 276m rotor diameter
WTG Foundations	49 monopiles of 12.5m diameter requiring seabed preparation	35 monopiles of 12.5m diameter or jacket foundations (three or four leg configurations, with 6m diameter pin piles) requiring seabed preparation
Offshore Substation Platform (OSP) Foundations (array area)	One OSP, with either a four-legged jacket foundation with pin piles, or one monopile; or two monopiles	One OSP, with either a four-legged jacket foundation with pin piles, or one monopile; or two monopiles
Cables	Installation of 111km of array cables within the array area and installation of two 18km export cables within the ECC	Installation of 91km of array cables within the array area and installation of two 18km export cables within the ECC

A presentation of the potential impacts in relation to Project Option 1 and Project Option 2 is provided, and the magnitude of those impacts in relation to the size and scale of the proposed development parameters. This enables the identification of the project option that will result in the greatest magnitude of impact on receptors and will therefore present the greatest potential for a likely significant effect (Table 18.5).

To determine the magnitude of the impact level, modelling, calculations and mapping have been undertaken for the project option with the greatest magnitude of impact, for all impacts for the relevant receptor/s.

The significance of effect assessment is then undertaken for both project options, which considers both receptor sensitivity and the magnitude of the impact and is detailed in Section 18.5.

Given the similarity of the project options, in most instances the conclusions are the same. In some instances, the difference in magnitude of impact between project options results in a different categorisation of significance.

18.4.1 Parameters for Assessment

The below activities, infrastructure and key design parameters have been considered within this chapter when determining the potential impacts. Further detail on the offshore elements of the proposed development is provided in the Offshore Description Chapter and Offshore Construction Chapter. These parameters apply to both project options and any differences in values that may require consideration have been identified in Table 18.15.

18.4.2 Construction

During construction the following activities and infrastructure have the potential to impact upon offshore archaeology and cultural heritage.

The installation of the foundations for the WTGs, potential scour protection, cables and cable protection have the potential to cause direct disturbance and damage to known and previously undiscovered artefacts of offshore archaeological significance. Dependent upon the design of installed features and methodology of installation, there may be a requirement for seabed preparation prior to installation which also has the potential to cause direct disturbance. Similar impacts may occur on surficial and shallow archaeology as a result of anchoring and jack-up vessel (JUV) activities associated with the construction works.

During construction the following activities and infrastructure have the potential to directly impact on offshore archaeology and cultural heritage:

- Seabed preparation prior to foundation installation and cable laying (methods include pre-lay grapnel run, trailing suction hopper dredger or mass flow excavation);
- Survey and clearance of unexploded ordnance (UXO);
- Installation of WTG and OSP monopile or jacket foundations;
- Placing of scour protection around WTG or OSP locations;
- Laying of inter-array and export cables (potential methods include jet trenching, mechanical trenching and ploughing);
- Backfilling of cable trenches and protection/stabilisation of surface laid marine cables (options include rock placement, concrete/frond mattresses);
- Landfall installation activities and cable installation within the intertidal zone; and
- Seabed contact from vessel anchors and/or feet from JUVs.

In addition to these direct impacts, as offshore archaeological assets have often survived as a result of a stable environment, changes to hydrodynamic and sedimentary processes could trigger renewed degradation as a result of changes in physical, biological or chemical processes. Thus, changes in sediment transport regimes leading to changes in seabed sediment levels (e.g. localised scour) could have indirect impacts upon offshore archaeological assets.

During construction the following activities and infrastructure have the potential to indirectly impact on offshore archaeology and cultural heritage:

- Changes to the sediment transport regime due to seabed preparation activities for WTG/OSP foundation and scour protection installation leading to changes in seabed sediment levels;
- Changes to the sediment transport regime due to seabed preparation for inter array cables, installation of inter array cables and associated cable protection leading to changes in seabed sediment levels;
- Changes to the sediment transport regime due to seabed preparation for export cables, installation of export cables and associated cable protection leading to changes in seabed sediment levels; and

- Dispersal of increased suspended sediment from arisings/plumes from construction activities potentially resulting in changes in seabed sediment levels.

18.4.3 Operational Phase

During operation, the following activities and infrastructure have the potential to impact on offshore archaeology and cultural heritage.

Direct impacts during operation could occur as a result of routine maintenance activities if these disturb the seabed, however as areas will already have been disturbed during construction there will be limited scope for impact and any impacts are likely to be of lower magnitude than during construction. Exceptional maintenance activities (outside of routine maintenance) have the potential to have a more significant impact than routine maintenance works on archaeological assets (for example if a cable needs to be replaced). However, given that known assets will have been avoided in the original layout, there will be limited potential for impacts from this source.

During operation and maintenance the following activities and infrastructure have the potential to directly impact on offshore archaeology and cultural heritage:

- Re-burial of cables;
- Repair/replacement of cables;
- Placement of additional cable protection; and
- Seabed contact from vessel anchors and/or feet from JUVs being used for any maintenance activities (although these are likely to be minimal).

In addition to these direct impacts, as offshore archaeological assets have often survived as a result of a stable environment, changes to hydrodynamic and sedimentary process could trigger renewed degradation as a result of changes in physical, biological or chemical processes. Thus, changes in sediment transport regimes leading to changes in seabed sediment levels (e.g. localised scour) could have indirect impacts upon offshore archaeological assets.

During the operational phase the following activities and infrastructure have the potential to indirectly impact on offshore archaeology and cultural heritage:

- Changes to the sediment transport regime due to the presence of structures on the seabed (WTG and OSP foundations) leading to changes in seabed sediment levels; and
- Changes to the sediment transport regime associated with inter array/export cable reburial, repair/replacement and additional cable protection leading to changes in seabed sediment levels.

18.4.4 Decommissioning

During decommissioning, the following activities and infrastructure have the potential to impact on offshore archaeology and cultural heritage.

Impacts arising during the decommissioning are expected to be similar to those experienced during the construction phase within the original impact footprint of construction activities. If decommissioning activities were to occur beyond the original construction footprint, they would be within the offshore development area. The following activities and infrastructure have the potential to directly impact on offshore archaeology and cultural heritage during decommissioning:

- Seabed contact from vessel anchors and/or feet from JUVs associated with the removal of infrastructure outside of previously disturbed areas within the offshore development area.

No indirect impacts have been identified for the decommissioning phase, as all decommissioning activity will be removing any causes of indirect impacts compared to the current baseline.

18.4.5 Embedded Mitigation Measures

The following embedded mitigation measures in Table 18.14 have been identified through the design and consultation process and are incorporated as part of the proposed development. The embedded mitigation measures will not be considered again at the residual effect stage.

Table 18.14: Embedded mitigation measures relating to offshore archaeology and cultural heritage

Measure	Mitigation detail
Construction	
HDD Installation	Use of HDD to entirely avoid any direct impact from cable corridor preparation and laying within the intertidal zone will decrease the magnitude of impact on these receptors to negligible.

18.4.6 Potential Impacts

The identification of potential impacts has been undertaken by considering the relevant characteristics from both project options (Table 18.13) and the potential for a pathway direct and indirect effects on known receptors (as identified in Section 18.3). Each identified impact relevant to offshore archaeology and cultural heritage is presented in Table 18.15.

For each impact, the relevant project characteristics of Project Option 1 and Project Option 2 are presented to determine the magnitude (size or extent) of the potential impact, defined by the proposed development parameters in the Offshore Description Chapter and in consideration of the WTG Limits of Deviation (LoD[2]), in line with the approach detailed in the EIAR Methodology chapter. A comparison of the project options has then been undertaken to determine which project option has the greatest magnitude of impact.

[2] Both Project Option 1 and Project Option 2 layouts have a 500m Limit of Deviation (LoD)

Table 18.15: Potential impacts and magnitude of impact per project option. The project option that has the greatest magnitude of impact is identified in blue

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest magnitude of impact
Construction			
1. Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	**Total area of direct physical impact: 6,545,844m^2.** **Total area of temporary habitat disturbance: 6,269,549m^2.** **Array area** Boulders required to be cleared across array area (IAC routes, WTG & OSP locations) & ECC = 9,817m^2. Seabed preparation at one OSP = 1,304m^2. Jack up vessel spud can footprint, anchoring operations, construction buoys (assumed 12) = 374,271m^2. Cable seabed preparation and installation in the array trench area affected: 111km length, 40m width (including preparatory seabed measures) = 4,440,000m^2. **ECC** Cable seabed preparation and installation in the ECC trench area affected: 18km length, 40m width (including preparatory seabed measures) = 1,440,000m^2. **Subtidal HDD** Total footprint of disturbance (exit pits, transition zone, temporary sidecast/ deposited material & JUV footprint) = 4,156m^2. **Habitat change from the presence of foundations, scour protection and cable protection: 276,296m^2.** Array area**:** WTG footprint with scour protection, based on 49 WTG =121,767m^2. One OSP foundations footprint = 4,778m^2.	**Total area of direct physical impact: 5,688,527m^2.** **Total area of temporary habitat disturbance: 5,391,017m^2.** **Array area** Boulders required to be cleared across array area (IAC routes, WTG & OSP locations) & ECC = 7,069m^2. Seabed preparation at one OSP = 1,304m^2. Jack up vessel spud can footprint, anchoring operations, construction buoys (assumed 12) = 275,303m^2. Cable seabed preparation and installation in the array trench area affected: 91km length, 40m width (including preparatory seabed measures) = 3,640,000m^2. **ECC** Cable seabed preparation and installation in the ECC trench area affected: 18km length, 40m width (including preparatory seabed measures) = 1,440,000m^2. **Subtidal HDD** Total footprint of disturbance (exit pits, transition zone, temporary sidecast/ deposited material & JUV footprint) = 4,156m^2. **Habitat change from the presence of foundations, scour protection and cable protection: 297,510m^2.** **Array area:** WTG footprint with scour protection, based on 35 WTG = 162,982m^2. One OSP foundations footprint = 4,778m^2. Pre- and post-lay rock berm area within array area (5 cable crossings) = 2,750m^2. Inter array cable protection (assuming 20% cable will require additional cable protection) = 91,000m^2.	**Project Option 1 represents the greatest magnitude of impact in relation to this impact** The greatest magnitude of impact for foundation installation results from the largest seabed area being directly impacted by the installation of infrastructure or the preparation of the seabed prior to installation. Project Option 1 has a higher total area of direct physical impact than Project Option 2 (857,317m^2 more area of impacted seabed) and presents the option with the greatest magnitude of impact.

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest magnitude of impact
	Pre- and post-lay rock berm area within array area (5 cable crossings) = 2750 m^2. Inter array cable protection (assuming 20% cable will require additional cable protection) = 111,000m^2. **ECC** Cable protection (assuming 20% cable will require additional cable protection) = 36,000m^2.	**ECC** Cable protection (assuming 20% cable will require additional cable protection) = 36,000m^2.	
2. Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to seabed preparation and installation activities for WTG and OSP foundations, and associated scour protection leading to changes in seabed levels. Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to seabed preparation and installation activities for inter array and export cables, and associated scour protection leading to changes in seabed levels. Further detail is provided in the Physical Processes chapter and Volume 3, Chapter 12: Benthic Subtidal and Intertidal Ecology.	Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to seabed preparation and installation activities for WTG and OSP foundations, and associated scour protection leading to changes in seabed levels. Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to seabed preparation and installation activities for inter array and export cables, and associated scour protection leading to changes in seabed levels. Further detail is provided in the Physical Processes chapter and Volume 3, Chapter 12: Benthic Subtidal and Intertidal Ecology.	**Project Option 1 represents the greatest magnitude of impact in relation to this impact.** The greatest magnitude of impact is likely to come from chances to hydrographic and sedimentary regimes where there is the largest area of seabed disturbance. Project Option 1 has a higher total area of disturbed sediment than Project Option 2 and presents the option with the greatest magnitude of impact.
Operation			
3. Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	**Total temporary habitat disturbance: 675,134m^2.** **Array area** JUV operations - Major WTG component repair/replacement = 646,540m^2. JUV - Major OSP component replacement = 13,195m^2. Inter array cable repair and/or replacement of cabling = 7,000m^2. Inter array cable reburial of any section of the offshore export cable which has become exposed = 700m^2. **ECC**	**Total temporary habitat disturbance: 490,409m^2.** **Array area** JUV operations - Major WTG component repair/replacement = 461,814m^2. JUV - Major OSP component replacement = 13,195m^2. Inter array cable repair and/or replacement of cabling = 7,000m^2. Inter array cable reburial of any section of the offshore export cable which has become exposed = 700m^2. **ECC** Export Cable - Repair and/or replacement of cabling = 7,000m^2.	**Project Option 1 represents the greatest magnitude of impact in relation to this impact.** The greatest magnitude of impact is likely to come from the impact of anchoring across the widest area of seabed disturbance. Project Option 1 has a higher total area than Project Option 2 (184,725m^2 more area of impacted seabed) and presents the option with the greatest magnitude of impact.

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest magnitude of impact
	Export Cable - Repair and/or replacement of cabling = 7,000m^2. Export Cable - Reburial of any section of the offshore export cable which has become exposed = 700m^2.	Export Cable - Reburial of any section of the offshore export cable which has become exposed = 700m^2.	
4. Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to presence of WTG and OSP structures on seabed leading to changes in seabed level. Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to repair/replacement of inter array/export cabling and associated cable protection leading to changes in seabed level. Further detail on hydrodynamic and sedimentary impacts is provided in the Physical Processes Chapter and Volume 3, Chapter 12: Benthic Subtidal and Intertidal Ecology.	Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to presence of WTG and OSP structures on seabed leading to changes in seabed level. Indirect disturbance caused by changes to the hydrodynamic and sedimentary regimes due to repair/replacement of inter array/export cabling and associated cable protection leading to changes in seabed level.	**Project Option 2 represents the greatest magnitude of impact in relation to this impact.** The greatest magnitude of impact is likely to come from chances to hydrographic and sedimentary regimes where there is the largest area of seabed disturbance. Project Option 2 has a higher total area than Project Option 1 and presents the option with the greatest magnitude of impact.
Decommissioning			
5. Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	The activities, sub-activities and potential impacts are as per the construction phase.	The activities, sub-activities and potential impacts are as per the construction phase.	N/A

18.5 Potential Effects

The likely significant effects, both beneficial and adverse, on offshore archaeology and cultural heritage for each stage of the proposed development are considered, specifically, the likely significant effects of the proposed development during its construction, operational, and decommissioning phases associated with the offshore development area. The environment in the vicinity of the proposed development is naturally dynamic, and as such will exhibit some level of natural variation and change over time whether the proposed development proceeds or not. Consequently, the identification and assessment of likely significant effects must be done in the context of natural change, both spatial and temporal.

18.5.1 Do-Nothing Scenario

Should the proposed development not be constructed, the baseline environment is unlikely to show future natural variations beyond that presented in the receiving environment (Section 18.3).

18.5.2 Construction Phase

This section presents the assessment of impacts arising from the construction phase of the proposed development.

18.5.2.1 Impact 1: Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors

If direct impacts were to occur upon the archaeological receptors that have been identified in Section 18.3 of this chapter and any potential archaeology within the study area, these are most likely to occur during the construction phase of the proposed development. Impacts resulting in negative effects upon archaeological assets as part of construction phase are those involving contact with the seabed and/or the removal of seabed sediments. Offshore archaeology and cultural heritage receptors with height, such as shipwrecks, may also be impacted by activities that occur within the water column, including pre-installation activities and cable installation activities. Construction activities that could potentially create direct physical impacts include but are not limited to:

- Pre-construction seabed preparation works (e.g. grapnel runs, save wave clearance);
- Installation of WTG and OSP foundations into the seabed;
- Trenching for installation of inter-array and export cables;
- Installation of cable protection materials;
- Installation of scour protection materials;
- JUV legs impacted on the seabed;
- Anchoring;
- Ship grounding.

Sensitivity of the receptor

All seabed and intertidal assets have the potential to be damaged or destroyed if they are directly impacted during the construction phase of the proposed development. Furthermore, all damage to archaeological sites or material would be permanent and recovery is limited to stabilisation or re-burial so as to limit further impact. There is no potential for the recoverability of any seabed assets if they are affected following a direct impact. As such, all wrecks, aircraft, associated material and debris and seabed prehistory are regarded as having high sensitivity.

All identified known and potential maritime, intertidal and palaeogeographic receptors and, currently unknown potential receptors are considered high sensitivity receptors as they have no recoverability from physical impacts.

In addition, maritime cultural heritage receptors are regarded as high value receptors either due to their age in the case of identified wrecks, or as a precautionary measure, where identification is not currently possible.

A total of three features of palaeogeographic interest have been identified (see Section 18.3). The potential for submerged landscape features and seabed prehistory assets represented by these features is high, as highlighted in Table 18.7 and they are considered high value receptors.

Magnitude of impact

The magnitude of direct impacts on known and potential maritime, aviation and intertidal receptors, and potential seabed features as part of construction activities, if they were to occur, would be high.

All direct impacts to offshore archaeology and cultural heritage would be permanent. Once archaeological deposits and material, and the relationships between deposits and material and their wider surroundings, have been damaged or disturbed it is not possible to reinstate or reverse those changes.

Impacts on known and potential seabed prehistory receptors, such as potential in situ prehistoric sites and submerged landscape features, could result in major effects, and these are considered as high value assets. For the array area, WTG foundation installation depths are anticipated to be down to 50m for monopiles and 60m for jackets (see Table 6.4 in the Offshore Description Chapter), whilst for cable burial for the inter-array cables and along the ECC this is anticipated to be 1m -3m (see Table 6.4 in the Offshore Description Chapter). Therefore, should potential seabed prehistoric features be impacted the footprint will vary between the array area and ECC. Taking a precautionary approach it is necessary to assume the magnitude of impacts would be high.

For intertidal archaeology, due to the use of HDD in order to avoid the intertidal zone entirely the magnitude of impact is negligible, as the area is to be entirely avoided by construction activities. The exit pits will be in the subtidal zone.

Significance of the effect

Overall, it is predicted that the sensitivity of the offshore archaeology and cultural heritage receptors for Project Option 1 and Project Option 2 is high, and the magnitude of the impact is high. The high sensitivity and high magnitude of the impact on offshore archaeology and cultural heritage receptors are assessed as resulting in a profound effect, which is significant in EIA terms.

Therefore, additional mitigation is required for known and potential submerged prehistory and known and potential maritime and aviation archaeology receptors.

No additional mitigation is required for known and potential intertidal archaeology receptors with high sensitivity, as predicted negligible magnitude impacts would result in not significant effects, which are not significant in EIA terms.

18.5.2.2 Impact 2: Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors

The indirect effects upon the known and potential offshore archaeological assets considered here are those which occur as a result of changes to hydrodynamic and sediment transport regimes leading to changes in seabed sediment levels (e.g. localised scour), where these changes would have occurred as a consequence of activities and structures associated with the construction activities. These effects may occur subsequent to the clearance of boulders during route preparation but may also occur through sediment dispersal/deposition or the placement of non-burial cable protection on the seabed. Construction activities that could potentially create indirect physical impacts include:

- Changes to the sediment transport regime due to seabed preparation activities for WTG/OSP foundation and scour protection installation leading to changes in seabed sediment levels;
- Changes to the sediment transport regime due to seabed preparation for inter array cables, installation of inter array cables and associated cable protection leading to changes in seabed sediment levels;
- Changes to the sediment transport regime due to seabed preparation for export cables, installation of export cables and associated cable protection leading to changes in seabed sediment levels; and
- Dispersal of increased suspended sediment from arisings/plumes from construction activities potentially resulting in changes in seabed sediment levels.

Sensitivity of the receptor

Indirect impacts may affect offshore archaeological baseline conditions where they result in the increased exposure or burial of offshore archaeological assets. The increased exposure of offshore archaeological assets has the potential to cause erosion and deterioration to the assets. Conversely, should assets be subject to increased sedimentation and burial, they may, in turn, benefit from conditions which afford higher levels of preservation. The Physical Processes Chapter suggests that the general regime of sediment accumulation would continue as previously and so the sensitivity of the receptors to continued sediment deposition is negligible as it is in effect protecting them either as presently or to a greater extent.

Magnitude of impact

The magnitude of impact of indirect impacts to offshore archaeological assets during installation is expected to be low, as all impacts identified related to the sediment transport regimes within the Physical Processes Chapter are either slight, not significant or imperceptible.

Consequently, the magnitude of impact from Project Option 1 and Project Option 2 resulting from temporarily elevated levels of siltation in intertidal habitats would be low.

Significance of effect

Overall, it is predicted that the sensitivity of the offshore archaeology and cultural heritage receptors for Project Option 1 and Project Option 2 is negligible, and the magnitude of the impact is low. The negligible sensitivity and low magnitude of the impact on offshore archaeology and cultural heritage receptors are assessed as resulting in an imperceptible effect, which is not significant in EIA terms.

Based on the predicted significance of effect it is concluded that no additional mitigation is required for this impact.

18.5.3 Operational Phase

This section presents the assessment of impacts arising from the operational phase of the proposed development.

18.5.3.1 Impact 3: Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors

Activities undertaken as part of the operational phase have the potential to impact offshore archaeology directly and indirectly, located on or under the seabed, resulting in their loss or the disruption of relationships between receptors and their wider surroundings.

Operational effects will be limited to those arising from cable repair/replacement, cable protection repair/replacement, maintenance or any monitoring that may be required. Potential direct impacts on offshore archaeology during operation of the proposed development could include:

- Re-burial of cables;
- Repair/replacement of cables;
- Placement of additional cable protection; and
- Seabed contact from vessel anchors and/or feet from JUVs being used for any maintenance activities (although these are likely to be minimal).

Sensitivity of the receptor

All seabed assets have the potential to be damaged or destroyed if they are directly impacted during the operational phase of the proposed development. Furthermore, all damage to archaeological sites or material is permanent and recovery is limited to stabilisation or re-burial so as to limit further impact. There is no potential for the recoverability of any seabed assets if they are affected following a direct impact. As such, all wrecks, aircraft, associated material and debris and seabed prehistory are regarded as having high sensitivity.

Magnitude of impact

The magnitude of direct impacts on potential maritime and aviation receptors, and potential seabed features as part of operation activities, if they were to occur, would be high. Any impact upon offshore archaeology, including any unknown archaeology would be permanent and irreversible.

Significance of effect

In areas where impact has already occurred during the construction phase, there is unlikely to be further effect.

However, in areas that have not yet been impacted, without mitigation, the effects on offshore archaeology are assessed as resulting in a profound effect due to their being permanent and non-recoverable, considered to be significant in EIA terms.

Overall, it is predicted that the sensitivity of the offshore archaeology and cultural heritage receptors for Project Option 1 and Project Option 2 is high, and the magnitude of the impact is high. The high sensitivity and high magnitude of the impact on offshore archaeology and cultural heritage receptors are assessed as resulting in a profound effect, which is significant in EIA terms.

18.5.3.2 Impact 4: Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors

The effects upon known and potential offshore archaeological assets considered here are those which occur as a result of changes to hydrodynamic and sediment transport regimes leading to changes in seabed sediment levels (e.g. localised scour), where these changes have occurred as a result of the presence of the WTG foundations, IAC and export cables, and the associated protection measures. Such impacts cause effects which afford increased protection to, or deterioration of, archaeological receptors. These include:

- Changes to the sediment transport regime due to the presence of structures on the seabed (WTG and OSP foundations) leading to changes in seabed sediment levels; and
- Changes to the sediment transport regime associated with inter array/export cable reburial, repair/replacement and additional cable protection leading to changes in seabed sediment levels.

Sensitivity of the receptor

Indirect impacts may affect offshore archaeological baseline conditions where they result in the increased exposure or burial of offshore archaeological assets. The increased exposure of offshore archaeological assets has the potential to cause erosion and deterioration to the assets. Conversely, should assets be subject to increased sedimentation and burial, they may, in turn, benefit from conditions which afford higher levels of preservation. The Physical Processes Chapter suggests that the general regime of sediment accumulation would continue as previously and so the sensitivity of the receptors to continued sediment deposition is negligible as it is in effect protecting them either as presently or further.

Magnitude of impact

The magnitude of impact of indirect impacts to offshore archaeological assets during installation is expected to be low, as all impacts identified related to the sediment transport regimes within the Physical Processes Chapter are either slight, not significant or imperceptible.

Consequently, the magnitude of impact from Project Option 1 and Project Option 2 resulting from temporarily elevated levels of siltation within the seabed sediments would be low.

Significance of effect

Overall, it is predicted that the sensitivity of the offshore archaeology and cultural heritage receptors for Project Option 1 and Project Option 2 is negligible, and the magnitude of the impact is low. The negligible sensitivity and low magnitude of the impact on offshore archaeology and cultural heritage receptors are assessed as resulting in an imperceptible effect, which is not significant in EIA terms.

18.5.4 Decommissioning

18.5.4.1 Impact 5: Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors

As with the construction phase, decommissioning activities have the potential to affect archaeological assets either directly or indirectly. The planned operational phase is 35 years. What infrastructure will be decommissioned and the methodology for doing so is not currently known but will be agreed prior to the commencement of decommissioning works and will be based upon current best regulations/practices and available technology, as described in the Offshore Description Chapter.

If the structures are left in-situ any likely significant effects from decommissioning will be avoided. If the proposed development structures are to be removed at decommissioning this appraisal assumes that impacts from decommissioning activities are of similar nature and extent to construction activities, with the decommissioning activities occurring in already developed seabed and with embedded mitigation strategies for construction and operational phases having been enacted. It is therefore assumed that the magnitude of the impact is negligible at decommissioning.

Significance of effect

Overall, it is predicted that the sensitivity of the offshore archaeology and cultural heritage receptors for Project Option 1 and Project Option 2 is high, and the magnitude of the impact is negligible. The high sensitivity and negligible magnitude of the impact on offshore archaeology and cultural heritage receptors are assessed as resulting in a not significant effect, which is not significant in EIA terms.

18.6 Mitigation and Monitoring Measures

Mitigation measures that were identified and adopted as part of the evolution of the proposed development design (embedded into the proposed development design) and that are relevant to offshore archaeology and cultural heritage are listed in Table 18.14 and not considered again here. Table 18.16 below identifies additional mitigation measures that are not embedded into the proposed development design. These measures will be set out in the EIAR Schedule of Environmental Commitments (see Volume 8, Appendix 6.1: Offshore Environmental Management Plan (EMP); hereafter the Offshore EMP).

Table 18.16: Mitigation relating to offshore archaeology and cultural heritage.

Measure	Mitigation description
Construction	
Archaeological review of geophysical and geotechnical datasets	Additional geophysical and geotechnical surveys will be undertaken prior to construction. In order to identify known and potential / currently unknown archaeological receptors, in line with EPA guidelines (EPA 2022) to facilitate avoidance of impacts (for example, in areas of currently partial geophysical survey coverage such as the array) the archaeological review of the additional geophysical and geotechnical datasets will be undertaken for the footprint of direct and indirect impacts prior to construction, and supporting operation & maintenance and decommissioning stages of the proposed development. The final locations of infrastructure within the 500m Limit of Deviation won't be confirmed until detailed site investigation and detailed design have been undertaken. The archaeological review of these additional survey data will enhance the design of the final positions of seabed infrastructure (e.g. WTGs, OSP, inter-array cabling) to facilitate avoidance of known and potential archaeological receptors. This mitigation applies to direct and indirect physical disturbance of archaeological receptors.
Archaeological Exclusion Zones (AEZs)	The main mitigation for the protection of known archaeological receptors is avoidance, in line with EPA guidelines (EPA 2022). The implementation and monitoring of Archaeological Exclusion Zones (AEZs) achieves this for the identified high value offshore archaeology and cultural heritage receptors. This mitigation applies to direct and indirect physical disturbance of archaeological receptors.
Protocols for Archaeological Discoveries (PAD)	A PAD is a system for reporting and investigating unexpected archaeological discoveries encountered during the different phases of the proposed development, with a Retained Archaeologist providing guidance and advising industry staff on the implementation of thePAD.

Measure	Mitigation description
	A PAD also makes provision for the implementation of temporary exclusion zones around areas of possible archaeological interest, for prompt archaeological advice, and, if necessary, for archaeological inspection and recording of important features prior to further activities in the vicinity. The PAD provides a mechanism to comply with legislation, including notification to the NMS. This mitigation applies to direct and indirect physical disturbance of archaeological receptors. The PAD is captured within the Offshore EMP.
Operation	
AEZs	The main mitigation for the protection of known archaeological receptors is avoidance, in line with EPA guidelines (EPA 2022). The implementation and monitoring of Archaeological Exclusion Zones (AEZs) achieves this for the identified high value offshore archaeology and cultural heritage receptors. This mitigation applies to direct and indirect physical disturbance of archaeological receptors.
PAD	A PAD is a system for reporting and investigating unexpected archaeological discoveries encountered during the different phases of the proposed development, with a Retained Archaeologist providing guidance and advising industry staff on the implementation of the PAD. A PAD also makes provision for the implementation of temporary exclusion zones around areas of possible archaeological interest, for prompt archaeological advice, and, if necessary, for archaeological inspection and recording of important features prior to further activities in the vicinity. The PAD provides a mechanism to comply with legislation, including notification to the NMS. This mitigation applies to direct and indirect physical disturbance of archaeological receptors. The PAD is captured within the Offshore EMP.
Decommissioning	
AEZs	The main mitigation for the protection of known archaeological receptors is avoidance, in line with EPA guidelines (EPA 2022). The implementation and monitoring of Archaeological Exclusion Zones (AEZs) achieves this for the identified high value offshore archaeology and cultural heritage receptors. This mitigation applies to the direct disturbance of archaeological receptors.
PAD	A PAD is a system for reporting and investigating unexpected archaeological discoveries encountered during the different phases of the proposed development, with a Retained Archaeologist providing guidance and advising industry staff on the implementation of the PAD. A PAD also makes provision for the implementation of temporary exclusion zones around areas of possible archaeological interest, for prompt archaeological advice, and, if necessary, for archaeological inspection and recording of important features prior to further activities in the vicinity. The PAD provides a mechanism to comply with legislation, including notification to the NMS. This mitigation applies to the direct disturbance of archaeological receptors.

18.6.1 Archaeological Exclusion Zones

AEZs will be implemented for these receptors within the offshore development area or where an AEZ around a receptor outside the offshore development area would encroach on the offshore development area. These are illustrated in Figure 18.5 and are as follows:

- for all receptors assigned a high value which may be impacted, an AEZ of 100m buffer is required: defined around the extent of the feature if mapped, or otherwise a central location or the reported position as appropriate; and
- for all receptors assigned a high value discrimination rating but which have no potential for impact due to being outside the offshore development area no AEZ is required.

Table 18.17: AEZs within the offshore development area

Site ID	Description	UTM30N Easting	UTM30N Northing	Recommended AEZ buffer
WA7000	High value, potential for impact	289332	5946816	100m
WA7001	High value, potential for impact	289796	5946725	100m

Site ID	Description	UTM30N Easting	UTM30N Northing	Recommended AEZ buffer
WA7002	High value, potential for impact	297073	5949027	100m
WA7003	High value, no potential for impact	297403	5947223	None: outside the ECC boundary by c.450m
WA7004	High value, no potential for impact	297387	5947239	None: outside the ECC boundary by c.450m
WA7005	High value, no potential for impact	298783	5947415	None: outside the ECC boundary by c.450m
WA7006	High value, potential for impact	299034	5948785	100m
WA7007	High value, potential for impact	302666	5951085	100m
WA7008	High value, potential for impact	303126	5951304	100m
WA7009	High value, potential for impact	311154	5944559	100m
WA7010	High value, potential for impact	299052	5948791	None, covered by AEZ for WA7006
WA7011	High value, potential for impact	299029	5948771	None, covered by AEZ for WA7006
WA7012	High value, potential for impact	302665	5951077	None, covered by AEZ for WA7007
WA7013	High value, potential for impact	303061	5951326	100m

18.7 Residual Effects

This section presents the residual effects of the proposed development once the mitigation outlined in Section 18.6 has been applied.

Where the mitigation presented in Section 18.6 has changed the effect level, this has been detailed.

The residual effects of the project options once mitigation has been applied are summarised in Table 18.19.

With the adoption of the additional mitigation measures, primarily by avoidance of known receptors by AEZs, the magnitude of significant effects (Impacts 1 and 3 above) will be reduced to negligible. Additionally, a PAD for unexpected archaeological discoveries will be in operation during the phases of the proposed development.

Table 18.18: Residual effects relating to offshore archaeology and cultural heritage

Potential Impact	Likely significant effect (pre-mitigation) – Project Option 1	Likely significant effect (pre-mitigation) – Project Option 2	Residual Effect – Project Option 1	Residual Effect – Project Option 2
Construction				
1. Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Profound	Profound	Not significant after the following mitigation: archaeological review of additional pre-construction geophysical and geotechnical datasets, implementation of archaeological exclusion zones (AEZs) and use of protocols for archaeological discoveries (PAD)	Not significant after the following mitigation: archaeological review of additional pre-construction geophysical and geotechnical datasets, implementation of AEZs and use of PAD

Potential Impact	Likely significant effect (pre-mitigation) – Project Option 1	Likely significant effect (pre-mitigation) – Project Option 2	Residual Effect – Project Option 1	Residual Effect – Project Option 2
2. Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Imperceptible	Imperceptible	Based on the predicted level of effect it is concluded that no additional mitigation is required. A PAD will be in effect, providing a route for reporting and managing unexpected archaeological discoveries. The residual effect will remain to be imperceptible	Based on the predicted level of effect it is concluded that no additional mitigation is required. A PAD will be in effect, providing a route for reporting and managing unexpected archaeological discoveries. The residual effect will remain to be imperceptible
Operation				
3. Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Profound	Profound	Not significant after the following mitigation: implementation of AEZs and use of PAD	Not significant after the following mitigation: implementation of AEZs and use of PAD
4. Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Imperceptible	Imperceptible	Based on the predicted level of effect it is concluded that no additional mitigation is required. A PAD will be in effect, providing a route for reporting and managing unexpected archaeological discoveries. The residual effect will remain to be imperceptible	Based on the predicted level of effect it is concluded that no additional mitigation is required. A PAD will be in effect, providing a route for reporting and managing unexpected archaeological discoveries. The residual effect will remain to be imperceptible
Decommissioning				
5. Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	Not significant	Not significant	Residual effect will remain not significant after the implementation of AEZs and use of PAD	Residual effect will remain not significant after the implementation of AEZs and use of PAD

18.8 Transboundary Effects

Transboundary effects are defined as those effects upon the receiving environment of other states, whether occurring from the proposed development alone, or cumulatively with other projects in the wider area.

There will be no direct impact on offshore archaeology and cultural heritage receptors beyond the offshore development area which is entirely within Irish waters. The indirect impacts identified above have all been evaluated as having insignificant effects which is not significant in EIA terms. There therefore will be no transboundary impacts with regard to offshore archaeology and cultural heritage and not considered further.

18.9 Cumulative Effects

Likely significant cumulative effects of the proposed development in-combination with proposed, approved and/or existing projects for offshore archaeology and cultural heritage have been identified, considered and assessed. The methodology for this cumulative assessment is a three-stage approach which is presented in the Cumulative and Inter-Related Effects Chapter.

The Cumulative and Inter-Related Effects Chapter contains the outcome of Stage 1 Establishing the list of 'Other Existing and/or Approved Projects'; and Stage 2 'Screening of 'Other Existing and/or Approved Projects'. This section presents Stage 3, an assessment of whether the proposed development in combination with other projects, grouped in tiers, would be likely to have significant cumulative effects.

The assessment specifically considers whether any of the developments in the local or wider area have the potential to alter the significance of effects associated with the proposed development. Developments which are already built and operating, and which are not identified in this chapter, are included in the baseline environment or have been screened out as there is no potential to alter the significance of effects. Developments which area already built and operating, which are identified in this chapter, have been identified as having ongoing impacts (which may be from operational and/or maintenance activities) which do not form part of the baseline that's been considered in Section 18.3.

The assessment of cumulative effects has considered likely significant effects that may arise during construction, operation and decommissioning of the proposed development. Cumulative effects were assessed to a level of detail commensurate with the information that has either been directly shared with the proposed development or was publicly available at the time of assessment.

Given the location and nature of the proposed development, a tiered approach to establishing the list of other existing and/or approved projects has been undertaken in Stage 1 of the cumulative effects assessment. The tiering of projects is based on project relevance to the proposed development and it is not a hierarchical approach nor based on weighting. Further information on the tiers is provided in Section 18.9.2 and in the Cumulative and Inter-Related Effects Chapter.

18.9.1 Offshore archaeology and cultural heritage cumulative screening exercise

The existing and/or approved projects selected as relevant to the cumulative effects assessment of impacts to offshore archaeology and cultural heritage are based on an initial screening exercise undertaken on a long list (see Cumulative and Inter-Related Effects Chapter), based on spatial distance to the proposed development. Consideration of effect-receptor pathways, data confidence and temporal and spatial scales has then allowed the selection of the relevant projects from the offshore archaeology and cultural heritage short-list.

When assessing likely significant effects for offshore archaeology and cultural heritage, projects were screened into the assessment based on a 10km screening range surrounding the array area, and a 10km range around the ECC based on an understanding of the location of receptors assessed in this chapter, and the ranges of sediment transport identified in the Physical Processes Chapter, excluding those that were already operational and therefore already part of the baseline environment.

For the full list of projects considered, including those screened out, please see the Cumulative and Inter-Related Effects Chapter and Appendix 38.2.

18.9.2 Projects considered within the cumulative effects assessment

The planned, existing and/or approved projects selected through the screening exercise as potentially relevant to the assessment of impacts to offshore archaeology and cultural heritage are presented in Table 18.19. The tiers for the assessment are:

- Tier 1 is limited to the Operation and Maintenance Facility (OMF) for the proposed development. The OMF option being considered, involves the adaption and leasing of a part of an existing port facility at Greenore. Further detail is provided in the Offshore Description Chapter.
- Tier 2 is the east coast Phase One Offshore Wind Farms.
- Tier 3 is all other projects that have been screened in for this topic.

The tiering structure is intended to provide an understanding of the potential for likely significant effects of the proposed development with the construction of its Operation and Maintenance Facility (OMF) (tier one); followed by a cumulative assessment of the likely significant effect of that scenario combined with the east coast Phase One Offshore Wind Farms (tier two); and lastly the combination of tier one and tier two with all other existing and/or approved projects that have been screened in (tier three).

Table 18.19 Projects and plans considered within the cumulative impact assessment

Development Type	Project	Status	Data Confidence	Distance to the proposed development		Justification for screening into the assessment
				Array area	ECC	
Tier 1	Operation and Maintenance Facility (OMF)	The project is not screened into the offshore archaeology and cultural heritage assessment as the proposed works are at a sufficient distance (beyond 10km screening range) and therefore will not have a physical effect-receptor overlap with the proposed development.				
Tier 2						
Phase One Offshore Wind Farm (OWF)	Oriel Wind Park	The Phase One OWFs are not screened into the offshore archaeology and cultural heritage assessment as the proposed works are at a sufficient distance (beyond 10km screening range) and therefore will not have a physical effect-receptor overlap with the proposed development.				
	Dublin Array					
	Codling Wind Park and Codling Wind Park Extension					
	Arklow Bank Phase 2					
Tier 3						
Other developments within 10km of proposed development infrastructure	No projects screened into the offshore archaeology and cultural heritage cumulative effects assessment as no relevant projects within 10km are anticipated to overlap in construction dates with the proposed development.					

18.9.3 Project impacts included in the assessment

The identification of potential impacts for the cumulative assessment is undertaken by considering the relevant characteristics from both project options (refer to Section 18.4) and the potential for a pathway for them to have direct and indirect effects on known receptors (as identified in Section 18.3) when combined with other projects.

For each impact, the project option with the greatest potential for a likely significant effect has been determined based on the comparison and justification provided in Table 18.15. The impacts considered in the cumulative assessment are presented in Table 18.20. As the residual effects for Project Option 1 and Project Option 2 are the same (as identified in Section 18.7), the cumulative effects assessment presented in this section applies to both options.

For cultural heritage and offshore archaeology, the screening process eliminated all other projects from the cumulative effects assessment (Table 18.19). This assumes that there is no potential for cumulative effects on marine cultural heritage receptors as a result of the proposed developments implemented mitigation measures (Section 18.4.5 and Section 18.6) (that will result in no significant residual effects); and the absence of physical effect-receptor overlap with other screened in projects.

To further demonstrate that this screening process outcome is correct, Table 18.20 provides the impacts that would have been considered.

Table 18.20: Impact Screening for cumulative effect for assessment

Impact	Potential for cumulative effect	Rationale
Construction		
Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	No	The application of mitigation measures as laid out in Table 18.16 will reduce the residual significance of effect to negligible, which is not significant in EIA terms. All direct impacts in this phase are related to works within the offshore development area. None of Tier 1 and 2 developments have spatial overlaps with the offshore development area. No Tier 3 developments within 10km have been screened into the assessment as those identified are already built with no ongoing impacts with a pathway to effect archaeology and cultural heritage receptors.
Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors	No	Impacts were assessed to be either minor or negligible as impacts were short term and highly localised. Therefore, residual effects were predicted to be not significant in EIA terms. None of the Tier 1 or Tier 2 developments are within the range of the indirect impact identified. No Tier 3 developments within 10km have been screened into the assessment as those identified are already built with no ongoing impacts with a pathway to effect archaeology and cultural heritage receptors
Operation		
Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	No	The application of mitigation measures as laid out in Table 18.16 will reduce the residual significance of effect to negligible, which is not significant in EIA terms. All direct impacts in this phase are related to works within the offshore development area. None of Tier 1 and 2 developments have spatial overlaps with the offshore development area. No Tier 3 developments within 10km have been screened into the assessment as those identified are already built with no ongoing impacts with a pathway to effect archaeology and cultural heritage receptors
Indirect physical disturbance of known and potential offshore archaeology and cultural heritage receptors	No	Impacts were assessed to be either minor or negligible as impacts were short term and highly localised. Therefore, residual effects were predicted to be not significant in EIA terms. None of the Tier 1 or Tier 2 developments are within the range of the indirect impact identified. No Tier 3 developments within 10km have been screened into the assessment as those identified are already built with no ongoing impacts with a pathway to effect archaeology and cultural heritage receptors
Decommissioning		
Direct physical disturbance of known and potential offshore archaeology and cultural heritage receptors	No	The application of mitigation measures as laid out in Table 18.16 will reduce the residual significance of effect to negligible, which is not significant in EIA terms. All direct impacts in this phase are related to works within the offshore development area. None of Tier 1 and 2 developments have spatial overlaps with the offshore development area. No Tier 3 developments within 10km have been screened into the assessment as those identified are already built with no ongoing impacts with a pathway to effect archaeology and cultural heritage receptors

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