Dublin Array
Generation for generations

# EIAR Volume 2: Offshore Infrastructure Assessment Chapters
# Chapter 13: Marine Arhcaeology

Kish Offshore Wind Ltd.

RWE SLR GoBe APEM Group

www.dublinarray-marineplanning.ie

# Dublin Array Offshore Wind Farm

## Environmental Impact Assessment Report

### Volume 3, Chapter 13: Marine Archaeology

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# Glossary

| Term | Definition |
|---|---|
| Archaeological Exclusion Zone (AEZ) | Areas where marine archaeological receptors are present, and which must be avoided during project works |
| Archaeological Management Plan (AMP) | A project specific document forming the agreement between the client, the appointed archaeologists, contractors and the relevant stakeholders. The document sets out methods to mitigate the effects on all known and potential marine archaeological receptors within the development area. |
| Bronze Age | Archaeological period lasting from 4,600-2,700 BP, characterised by the increasing use of Bronze. Subdivided into Early, Middle and Late Bronze Age. |
| Coastal processes | The processes that interact to control the physical characteristics of a natural environment, for example: wind, waves, current, water levels, sediment transport, turbidity, coastline, beach and seabed morphology. |
| Early Medieval | Archaeological period for the date of the breakdown of Roman rule in Britain c. 410 AD to the Norman invasion in 1066 AD. |
| Early Prehistoric | Archaeological period lasting from 52,000 to 6,000 BP, used for monuments, sites and finds characteristic of the Palaeolithic to Mesolithic, but cannot be specifically assigned. |
| Effect | Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance or sensitivity (value) of the receptor or resource in accordance with defined significance criteria. |
| Impact | The changes resulting from an action. |

| Term | Definition |
|---|---|
| Inshore | The sea up to two miles from the coast. |
| Intertidal | The area of the shoreline which is covered at high tide and uncovered at low tide. |
| Iron Age | Archaeological period from 2,800 BP to 43 AD, perceived to end with the start of the Roman invasion. Characterised by the use of iron for making tools and monuments such as hillforts and oppida. |
| Marine Archaeological Study Area | A 1.5 km buffer around the array area and the Offshore export cable corridor, up to mean high water springs. |
| Medieval | Archaeological period lasting from 1066-1540 AD, also referred to as the Middle Ages. Follows the Early Medieval (410-1066 AD) and begins with the Norman invasion and ends with the dissolution of the monasteries. |
| Mesolithic | Archaeological period lasting from 12,000 to 6,000 BP. The Middle Stone Age, occurring between the Palaeolithic and Neolithic, marking a beginning of a move from a hunter-gatherer society towards a sedentary production society. |
| Nanotesla (nT) | Measurement describing the magnetic field (flux) of ferrous materials as measured by a magnetometer. |
| Neolithic | Archaeological period lasting from 6,000 to 4,200 BP. Follows on from the Mesolithic and is succeeded by the Bronze Age. Characterised by the practice of a farming economy and extensive monumental constructions. |
| Offshore | The sea further than two miles from the coast. |
| Palaeolithic | Archaeological period lasting from 52,000 to 12,000 BP. Defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into the Lower, Middle and Upper Palaeolithic. |
| Post Medieval | Archaeological period lasting from 1540-1901 AD. |
| Protocol for Archaeological Discoveries (PAD) | Document detailing how unexpected archaeological discoveries should be reported during the lifetime of the project |
| Roman period | Archaeological period lasting from 43-410 AD. Begins with the Roman invasion in 43 AD and ends with the emperor Honorius directing Britain to look to its own defences in 410 AD. |
| Scour | A localised sediment erosion feature caused by local enhancement of flow speed and turbulence due to interaction with an obstacle. |
| Significance | A measure of the importance of the environmental effect, defined by criteria specific to the environmental aspect. |

# Acronyms

| Term | Definition |
|---|---|
| ADO | Alternative Design Option |
| AEZ | Archaeological Exclusion Zone |

| Term | Definition |
|---|---|
| AMP | Archaeological Management Plan |
| BCE | Before Common Era |
| BIIS | British-Irish Ice Sheet |
| BP | Before Present |
| CD | Chart Datum |
| CIfA | Chartered Institute of Archaeologists |
| DCHG | Department for Culture, Heritage and the Gaeltacht |
| DECC | Department of Environment, Climate and Communications (formerly the Department of Communications, Climate Action and Environment) |
| ECC | Export Cable Corridor |
| EIA | Environmental Impact Assessment |
| EIAR | Environmental Impact Assessment Report |
| EIS | Environmental Impact Statement |
| EPA | Environmental Protection Agency |
| IAI | Institute of Archaeologists of Ireland |
| INFOMAR | Integrated Mapping for the Sustainable Development of Ireland's Marine Resource |
| LGM | Last Glacial Maximum |
| MA | Maritime Archaeology Limited |
| MDO | Maximum design option |
| MBES | Multibeam Echo Sounder |
| MHWS | Mean High Water Springs |
| NMI | National Museum of Ireland |
| NMS | National Monument Service |
| nT | Nano Tesla |
| OSP | Offshore Substation Platform |
| PAD | Protocol for Archaeological Discoveries |
| SSS | Side Scan Sonar |
| UAU | Underwater Archaeology Unit |
| UHR / 2DUHR | Ultra-High Resolution Seismic Survey / 2-Dimensional Ultra-High Resolution Seismic Survey |
| UK | United Kingdom |
| UKHO | United Kingdom Hydrographic Office |
| WIID | Wreck Inventory of Ireland Database |
| WTG | Wind Turbine Generator |

| Term | Definition |
| --- | --- |
| ZoI | Zone of Influence |

# 13 Marine Archaeology

## 13.1 Introduction

13.1.1 This chapter presents the results of the assessment for the potential impacts of the construction, operation and maintenance (O&M), and decommissioning phases within the array area and offshore Export Cable Corridor (the latter referred to as the Offshore ECC) on marine archaeology and cultural heritage, covering known and potential underwater cultural heritage, including shipwrecks and palaeolandscapes.

13.1.2 This EIAR chapter should be read in conjunction with the following documents included within the EIAR, due to interactions between cultural heritage aspects:

- Volume 4, Appendix 4.3.13-1: Marine Archaeology Technical Baseline;
- Volume 4, Appendix 4.3.13-2: Stage 1 Geoarchaeological Report;
- Volume 4, Appendix 4.3.13-3: Geophysical Survey 2021: Archaeological Report to support Detection Device Licence 21R0027;
- Volume 7, Appendix 7: Archaeological Management Plan (AMP) – including a Protocol for Archaeological Discoveries (PAD);
- Volume 4, Appendix 4.3.13-4: Intertidal Archaeological Survey Report
- Volume 3, Chapter 1: Marine Geology, Oceanography and Physical Processes (hereafter referred to as the Physical Processes chapter) - for indication on seabed sediment movements potentially impacting marine archaeological receptors;
- Volume 4, Appendix 4.3.1-1: Physical processes technical baseline (hereafter referred to the Physical Processes technical baseline) – provides a detailed characterisation of the receiving environment;
- Volume 4, Appendix 4.3.14-1: Archaeology and Cultural Heritage Settings Baseline (Offshore Impacts);
- Volume 5, Chapter 8: Archaeology Cultural Heritage - provides a holistic understanding of cultural aspects of the onshore study area;
- Volume 3, Chapter 14: Cultural Heritage Settings Assessment (Terrestrial); and
- Volume 3, Chapter 15: Seascape, Landscape and Visual Impact Assessment - for in depth discussion on changes to the seascape.

13.1.3 The technical baseline (Volume 4, Appendix 4.3.13-1 of the EIAR, hereafter referred to as the Marine Archaeology Technical Baseline) provides a detailed characterisation of the marine archaeological receptors and the receiving environment. Information and results deriving from the baseline report have been summarised within this chapter.

13.1.4 Further archaeological work undertaken ahead of this EIAR is presented in Volume 4, Appendix 4.3.13-2 which includes the Stage 1 Geoarchaeological Assessment of Geotechnical Cores (hereafter referred to as the Stage 1 Geoarchaeological assessment) and Volume 4, Appendix 4.3.14-1 that presents the Archaeology and Cultural Heritage Settings Baseline (hereafter referred to as the Onshore Archaeology baseline).

13.1.5 An Archaeological Management Plan (AMP) is included in Volume 7, Appendix 7, (hereafter referred to as the Archaeological Management Plan) which has been developed to describe principles and actions for mitigation, avoidance and investigation for all parties and sets out the basis for archaeological mitigation of the Dublin Array Offshore Wind Farm proposed development.

13.1.6 The AMP document is intended to ensure that relevant personnel involved in the construction, operation and maintenance, and decommissioning of the offshore infrastructure, including the wind farm project team and all of the associated contractors, are aware of and understand archaeological mitigation measures, and how and when to apply them.

13.1.7 The AMP sets out roles and responsibilities and formal lines of communication, outlines the mitigation and archaeological actions, sets out the importance of research frameworks in setting objectives that are delivered through the realisation of work and provides summarised details on the methodologies for proposed actions. Furthermore, the AMP will include a Protocol for Archaeological Discoveries (PAD), which is a system developed for monitoring and reporting unexpected and incidental archaeological and historical finds where an archaeologist is not present on site or immediately available. Note that the PAD is not a replacement for the other mitigation measures but supplementary to them, as detailed in Table 15.

# 13.2 Regulatory background

13.2.1 The legislation, policy and guidance relevant to the whole planning application is set out in Volume 2, Chapter 2: Consents, Legislation, Policy & Guidance (Hereafter referred to as the Policy Chapter). The principal legislation, policy and guidance relevant to this chapter is set out in Annex A.

13.2.2 The assessment of potential impacts upon marine archaeological receptors has been made with specific reference to the relevant regulations, guidelines and guidance, which include:

- Relevant national legislation:
    - National Monuments Acts 1930-2004 (as amended); Act which makes provision for the protection and preservation of national monuments and for the preservation of archaeological objects;
    - Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023; Act which ensures greater legal protection to newly discovered and existing archaeological sites;

- Merchant Shipping (Salvage and Wreck) Act 1993; Act which sets out the statutory role of the director of the NMI regarding notifications of unclaimed wreck from the assigned Receiver of Wreck and retention on behalf of the State if unclaimed wreck is of archaeological interest;

- Heritage Act 1995, 2018 (as amended); Act to promote public interest in and knowledge, appreciation, and protection of the national heritage;

- Dumping at Sea Act 1996 to 2009 (and various amendments); Act to control dumping at sea and give effect to the convention for the protection of the marine environment;

- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999; Act to provide for the establishment of a national inventory of architectural heritage and for related matters;

- Minerals Development Act 2017 29. (1c); Act to make further and better provision for the development of minerals and reduce or add to land specified in application to protect areas of archaeological heritage;

13.2.3 Where specific Irish guidance is not available given the infancy of offshore wind in Ireland, a number of other guidance documents are considered. Such guidance documents are available from jurisdictions/countries with established offshore renewable energy sectors where comprehensive guidance has been developed. Where appropriate, the UK guidance for archaeological assessments has been chosen to supplement the existing Irish guidance on the basis of its close geographical, historical, and cultural links, as well as the recent increase in offshore renewable wind projects in the UK fully incorporating marine archaeological studies in the EIA process. The assessment of potential impacts upon marine archaeological receptors has been made with specific reference to the relevant regulations, guidelines and guidance within the Policy Chapter and those listed below:

- Guidance and guidelines

  - Frameworks and Principles for the Protection of the Archaeological Heritage (Department of Arts, Heritage, Gaeltacht and the Islands, 1999a); outlines the basic principles and approaches for the protection of archaeological heritage in Ireland. It also outlines statutory roles and obligations of stakeholders;

  - Policy and Guidelines on Archaeological Excavation (DAGH[1]I),1999b;

  - Advice to the Public on Ireland's Underwater Cultural Heritage, Department of Housing, Local Government and Heritage, 2022;

[1] Department of Arts, Heritage, Gaeltacht and the Islands

- Institute of Archaeologists Ireland (IAI) Codes of Conduct; relating to the professional practice of archaeology with the aim of improving archaeological standards throughout the island of Ireland in relation to Professional Conduct; Archaeological Assessment Excavation; Archaeological Monitoring; Treatment of Archaeological Objects; and Treatment of Human Remains;
- International Council on Monuments and Sites (ICOMOS) guidance, non-governmental international organisation dedicated to the conservation of the world's monuments and sites;
- United Nations Educational, Scientific and Cultural Organisation (UNESCO) guidance, who seek to encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity;
- European Convention on the Protection of the Archaeological Heritage (Valetta Convention) signed by Ireland in 1997;
- Convention Concerning the Protection of the World Cultural and Natural Heritage, UNESCO, 1972. Ratified by Ireland in 1991;
- Standards and guidance for historic environment desk-based assessment, Chartered Institute for Archaeologists (CIfA, 2014a);
- Standard and guidance for commissioning work on, or providing consultancy advice on archaeology and the historic environment (CIfA, 2014b);
- Historic Guidance for Offshore Renewable Energy Sector, Collaborative Offshore Wind Research into the Environment (COWRIE, 2008);
- JNAPC Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee, 2006);
- Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021); and
- Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014).

13.2.4 The relevance of the above (and other relevant legislation and policy identified within the Policy Chapter) with regards to marine archaeology and how these have been addressed within this assessment are presented in Annex A of this chapter.

## 13.3 Consultation

13.3.1 As part of the EIA for Dublin Array, non-statutory consultation has been undertaken with various statutory and non-statutory bodies. A Scoping report (RWE, 2020) was made publicly available and issued to statutory consultees on 9th October 2020.

13.3.2 In addition, consultation has been undertaken with the Underwater Archaeology Unit (UAU) (on behalf of the National Monument Service) and the Department of Housing, Local Government and Heritage (DHLGH). Table 1 provides a summary of the consultation undertaken for marine archaeology.

Table 1 Summary of consultation relating to marine archaeology

| Date | Consultation type | Consultation and key issues raised | Section where provision is addressed |
|---|---|---|---|
| 19 May 2019 | In-person meeting | Summary of project objectives, summary of licenses required for surveys and clarifications on baseline assessment requirements. | Project survey objectives and baseline assessment requirements and summarised in Section 13.4 and 13.6 and further detailed in the Marine Archaeology Technical Baseline. |
| 21 January 2020 | Email exchange | Confirmation of required geophysics standards for marine archaeological survey. | Survey parameters summarised in Section 13.4 and further detailed in the Marine Archaeology Technical Baseline. |
| 20 May 2020 | Telephone call | Discussion regarding UAU response to consultation on an application under section 3 of the Foreshore Act 1933, as amended, for a licence to carry out *inter alia* archaeological investigation, including the extent of archaeological exclusion zones, process for review of geophysical data and approval from UAU prior to investigations and reporting requirements. | Details of the archaeological investigation, the interpretation of the results and the archaeological exclusion zones within the Dublin Array Offshore Wind Farm development area are found in the Marine Archaeological Technical Baseline and Archaeological Management Plan. |
| 18 May 2021 | On-line meeting | Review analysis of geophysical data in vicinity of proposed MetOcean buoy deployment locations and clarification of preferred terminology and classification of anomalies. | Table 4 Definition of archaeological categories used in the geophysical assessment. |
| 13 January 2022 | On-line meeting | Meeting to discuss UAU comments on an | Section 13.6 describes the |

| Date | Consultation type | Consultation and key issues raised | Section where provision is addressed |
| --- | --- | --- | --- |
| | | application Under section 3 of the Foreshore Act 1933, as amended, for a licence to carry out inter alia archaeological investigations. | baseline environment and archaeological potential of the development area and surrounding environment. |
| 10 July 2024 | On-line meeting | Confirmation from UAU that they will review the Archaeological Management Plan prior to the submission of the application. | Section 13.13 describes the AMP mitigation |
| 3 December 2024 | Email correspondence | Feedback following the submission of a draft version of the AMP. | Feedback implemented throughout the submitted final version of the AMP. |

# 13.4 Methodology

13.4.1 For a full description of the methodology as to how this EIAR was prepared, see Volume 2 Chapter 3: EIA Methodology (hereafter referred to as the EIA Methodology Chapter). The methodology that follows below is specific to this chapter.

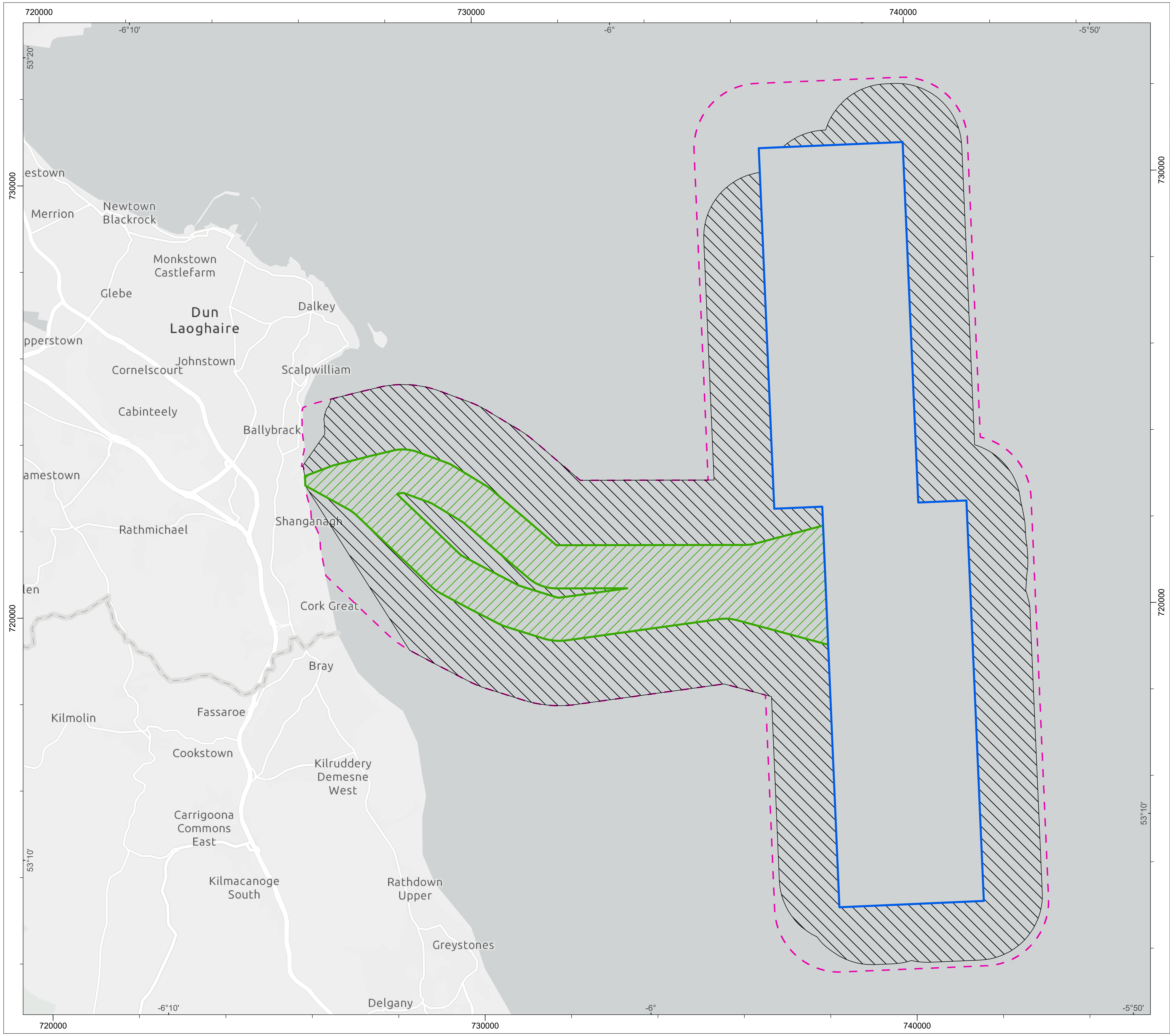
## Study area

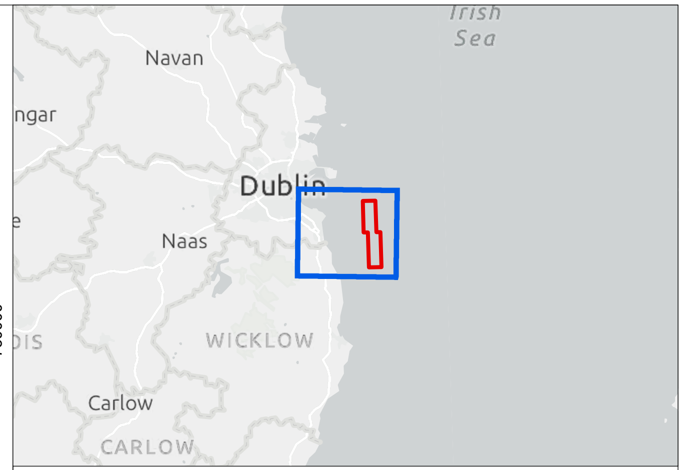
13.4.2 Figure 1 illustrates the marine archaeology study area for the purposes of the marine archaeological assessment. The marine archaeology study area comprises of a 1.5 km buffer around the array area and the Offshore export cable corridor[2] (Offshore ECC) , up to mean high water springs (MHWS) (hereafter referred to as the marine archaeology study area), incorporating the temporary occupation area and extending around the entirety of the development area capturing an additional area around the array area and the landfall, for completeness.

13.4.3 The marine archaeology study area has been applied up to MHWS to ensure there is no gap with the onshore archaeological works where the study area extends down to MHWS, see Onshore Archaeology baseline. The marine archaeology study area has been used to increase the potential for identification and preservation of any known marine archaeological receptors located in proximity to the proposed development as recorded losses of ships, especially historical accounts, are not always accurate.

[2] All distances are taken from the outer boundary of all offshore works incorporating the offshore infrastructure, the buffer also incorporates the temporary occupation area and as such are inherently precautionary

13.4.4 Additionally, the marine archaeology study area accommodates the potential for previously unknown or unlocated archaeology located within the proposed development area to be identified during the assessment of data and ensures appropriate mitigation can be applied.




- Array Area
- Export Cable Corridor
- Offshore Temporary Occupation Area
- MarineArchaeology Study Area

**DRAWING STATUS** FINAL

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**MAP NOTES / DATA SOURCES:**
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community ©Ordnance Survey Ireland 2023 © Tailte Eireann. (CYSL50270365) Not to be used for Navigation.

**PROJECT TITLE** Dublin Array

**DRAWING TITLE** Marine Archaeology Study Area and Offshore Temporary Occupation Area

**DRAWING NUMBER:** 01 **PAGE NUMBER:** 1 of 1

| VER | DATE | REMARKS | DRAW | CHEK | APRD |
|---|---|---|---|---|---|
| 01 | 2024-05-03 | DRAFT | HA | CH | ##### |

0 0.7 1.3 2 2.6 Kilometers
0 1 1 2 2 Miles

N GRID NORTH

| | | | |
|---|---|---|---|
| SCALE | 1:90,000 | PLOT SIZE | A3 |
| DATUM | WGS 1984 | VERTICAL REF | ODN/LAT/MLLW |
| PRJ | WGS 1984 UTM Zone 29N | | |

MARITIME ARCHAEOLOGY

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## Baseline data

13.4.5 Site-specific surveys as detailed in Table 2 were used to characterise the known and potential marine archaeological receptors within the marine archaeology study area. The detailed methodology for the assessment is presented in 13.4 and the characterisation results are summarised in Section 13.6 with full details presented in the Marine Archaeology Technical Baseline.

Table 2 Dublin Array Offshore Wind Farm site specific data

| Date source | Summary | Coverage of Dublin Array Offshore Wind Farm |
|---|---|---|
| RWE Renewables Ireland Ltd. (2022). Dublin Array Offshore Wind Farm Geophysical Survey 2021: Archaeological Report. Detection Device Licence 21R0027 | Archaeological assessment of baseline environment and geophysical survey taken over the array area and Offshore ECC, including side scan sonar, magnetometry, bathymetry, and sub-bottom data. | Full coverage of the Dublin Array Offshore ECC and array area. |
| Niall Brady and Dominick Gallagher, 'Archaeological monitoring, Dublin Array Benthic Survey. 21E0082' (ADCO 2021). | Archaeological monitoring of the benthic survey conducted for the Dublin Array Offshore Wind Farm took place and a record was made of the observations and samples recovered. No archaeologically significant material was recorded. | Coverage within Dublin Array Offshore ECC and array area. |
| Niall Brady, 'Archaeological intertidal survey, Ringsend, Dublin Array. 21D0045, 21R0070' (ADCO 2021). | Archaeological intertidal survey conducted for the Dublin Array Offshore Wind Farm took place of the proposed cable landfall location at Ringsend, Co. Dublin. No archaeologically significant material was recorded. | Coverage outside of the current scope of Dublin Array ECC and intertidal area, however in close proximity. |
| Niall Brady, 'Archaeological intertidal survey, Shanganagh, Dublin Array. 21D0046, 21R0071' (ADCO 2021). | Archaeological intertidal survey conducted for the Dublin Array Offshore Wind Farm took place of the proposed cable landfall location at Shanganagh, Co. Dublin. The survey highlighted the footings of the former retaining wall for the nineteenth-century railway that are exposed along much of the southern half of the survey area. The wall base is revealed at Low Water. It is not a registered archaeological site. However, it is a heritage asset and should be considered as such. | Coverage within Dublin Array Offshore ECC intertidal areas. |

13.4.6 The assessments of the site-specific surveys are supported by a baseline assessment to inform the archaeological and environmental context and to identify deposits of archaeological potential using the sources detailed in Table 3. The results are summarised in Section 13.6 and presented in detail in the Marine Archaeology Technical Baseline.

Table 3 Sources used for marine archaeology assessment

| Date source | Summary | Coverage of Dublin Array Offshore Wind Farm |
|---|---|---|
| Dublin Array Environmental Impact Statement (2012/2013 baseline)[3] | Baseline data collated over a period extending back to the commencement of the development phase of the project (Appendix D of Dublin Array Environmental Statement, 2013). | Marine archaeology study area |
| Archaeological Excavations Bulletin | Irish database compiled from the published Excavations Bulletin from the year 1970-2010 and includes additional online-only material from 2011 onwards. The map search was used to find relevant reports. | Data collected from 1970 to date across Ireland |
| Brooks and Edwards Sea-level Database for Ireland (2006) | This data was consulted to inform the palaeoenvironmental potential of the marine archaeology study area. | Ireland wide |
| Heritage Maps Viewer | The Heritage Maps Viewer is run by the Heritage Council (HC). It contains compiled heritage data for Dublin County. However, it is important to note that the data is still in the process of being uploaded to the database as it is a relatively new website. It was used primarily to access archaeological reports from assessments and excavations in the area. | Ireland wide, including offshore environment |
| Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) Shipwreck Database | INFOMAR aims to map the physical, chemical, and biological features of Ireland's seabed. The shipwreck data was downloaded in vector form and contained all Irish shipwrecks, their known location and associated information. | Waters around Ireland, data taken from surveys undertaken since 1999 |
| INFOMAR Geophysical Data | The geophysical data from INFOMAR was assessed in ArcGIS to identify any additional targets or anomalies in the study area. | Waters around Ireland, data taken from surveys undertaken since 1999 |

[3] https://www.gov.ie/en/foreshore-notice/60c81-bray-offshore-wind-ltd/

| Date source | Summary | Coverage of Dublin Array Offshore Wind Farm |
|---|---|---|
| National Museum of Ireland (NMI) | The topographical files relating to the townlands along the coast from Dublin Bay, Co. Dublin to Bray, Co. Wicklow were consulted at the NMI in Dublin. Although the archives of twenty townlands were investigated, only five returned relevant records, including: Blackrock, Bray, Dalkey Island, Killiney and Sandymount. | Ireland wide |
| Sites and Monuments Records (SMR), held by the National Monuments Service (NMS) | The SMR onshore and intertidal data was made available through the online Historic Environment Viewer database. A polygon was created to include the townlands along the coastline from Howth, Co. Dublin to Bray, Co. Wicklow and extended from MHWS to approximately 1km inland. | Ireland wide |
| United Kingdom Hydrographic Office (UKHO) via INFOMAR | UKHO wrecks are included in the INFOMAR data and are categorised as:<br>1. Obstruction; or<br>2. Wreck<br>3. and classified as:<br>4. LIVE, detected in recent surveys;<br>5. DEAD, not detected in recent surveys; or<br>6. LIFT, removed from the sea floor. | As above INFOMAR database |
| Wrecksite.eu | Database used to find additional information and wreck reports for identified shipwrecks in both the UKHO and INFOMAR datasets. | International |
| Wreck Inventory of Ireland Database (WIID), held by the National Monument Service (NMS) | Data from the WIID was downloaded from the NMS online Wreck Viewer. The known locations of wrecks are represented, however, these only account for c. 22% of the total number of records held by the NMS. The coordinates given represent the known approximate centre of the record and is not indicative of its geographic extent. | Recorded wrecks across Ireland's waters out to the continental shelf |
| Reports produced ahead of the Kish and Bray | EIS-Vol 3, Archaeological Assessment for the Kish and Bray Banks Offshore Wind Farm Development, Co. Dublin and Co. | Archaeological and geophysical assessment undertaken within Dublin Array Offshore |

| Date source | Summary | Coverage of Dublin Array Offshore Wind Farm |
|---|---|---|
| Banks Offshore Wind Farm Development[4] | Wicklow (Headland Archaeology, 2009);<br>Dublin Array - An Offshore Wind Farm on the Kish and Bray Banks Environmental Impact Statement Revision 1 (Saugus Energy Limited, February 2012);<br>Dublin Array - An Offshore Wind Farm on the Kish and Bray Banks Environmental Impact Statement Volume 1 Non-Technical Summary (Saorgus Energy Limited, February 2013a); and,<br>Dublin Array - An Offshore Wind Farm on the Kish and Bray Banks Environmental Impact Statement. Addendum (Saorgus Energy Limited, February 2013b). | ECC and array area and the wider area |

## Assessment methodology

13.4.7 The baseline characterisation was compiled utilising the data sources detailed in Table 2 and Table 3 ensuring that the marine archaeological assessment is comprehensive and robust. The baseline characterisation has been informed by a desk-based study of known archaeological resources, a review of the geophysical site investigations conducted for the project, and on-site inspections and surveys that have included an offshore archaeological watching brief and walkover surveys of the foreshore and intertidal elements. The assessment of the archaeological potential of the environment where development is proposed is used to inform the impact assessment (Sections 13.14, 13.15, 13.16 and 13.17).

13.4.8 Known archaeological sites within the marine archaeology study area, as well as the wider area, were used to inform archaeological potential. For the marine zone, the two databases used, the Wreck Inventory of Ireland Database (WIID) and the Integrated Mapping for Sustainable Development of Ireland's Marine Resource (INFOMAR) databases, were cross-referenced to remove duplicate entries. Where relevant the wrecksite.eu database was used to provide more detail on the known wrecks identified within marine archaeology study area.

13.4.9 There is potential for previously undiscovered or unrecorded archaeology to be identified through the assessment of the geophysical data, and through other aspects of project works as historical records are not complete. Methodologies for the assessment of geophysical and site-survey data has been included below and proposed mitigation measures to avoid impact on known and potential archaeology within the marine archaeology study area are described in Section 13.13.

[4] https://www.gov.ie/en/foreshore-notice/60c81-bray-offshore-wind-ltd/

## Methodology for the archaeological assessment of geophysical data

13.4.10 Fugro Ltd. was contracted by the Applicant to acquire shallow geophysical and Ultra-High Resolution Seismic (UHRS) data across the marine archaeology study area. Surveys over the array area commenced on 25 February 2021 and were completed on 27 April 2021, and those covering the Offshore ECR, which included the north and south route, and a cable route option to Poolbeg which is now no longer being considered, commenced on 25 February 2021 and were completed on 2 May 2021. A section of the proposed offshore export cable route covering approximately 12.2 $km^2$ was not covered by the 2021 Fugro data, however records for losses and obstruction in this area have been included in the baseline assessment and mitigation recommendations for Archaeological Exclusion Zones (AEZ).

13.4.11 The Fugro Mercator was tasked with carrying out geophysical and Ultra-High resolution (UHR) seismic surveys in the array area and the Offshore ECC. A third-party vessel, the Spectrum 1 also carried out geophysical surveys to acquire data for the project over the shallowest parts of the Bray and Kish banks in water depths of <7m. The Fugro Seeker conducted geophysical surveys of the nearshore of the geophysical survey extent in water depths <7m.

13.4.12 The geophysical data was assessed by Maritime Archaeology Ltd (MA); a Chartered Institute for Archaeologists (CIfA) registered organisation. MA Ltd are experienced consultants who work with several offshore projects to identify underwater cultural heritage and to mitigate the impacts to them. MA Ltd are also producing the Archaeological Management Plan and Protocol for Archaeological discoveries.

13.4.13 All MA Ltd projects have been co-ordinated by the same core team over the last 10 years. Deliverables are managed by Brandon Mason who co-ordinates all phases of assessment and reporting and represents clients at relevant stakeholder meetings and telecons. Baseline and specialist assessment are delivered by a small and highly experienced team led by Christin Heamagi, senior consultant and technical lead. Project steering and representation at examination and public hearings is provided by Project Director, Garry Momber. Quality assurance is delivered by Julie Satchell.

13.4.14 Christin Heamagi has extensive experience working in offshore renewable energy projects and is currently the project Lead for the Dublin Array Offshore Wind Farm. On this project, Christin has facilitated stakeholder engagement and been instrumental in the development of cultural heritage mitigation for the project. During the course of this work, Christin has worked and developed a positive working relationship with the UAU.

13.4.15 The author, Heather Anderson, who also conducted the geophysical assessment for this project, has several years' experience in working on offshore renewable energy projects across the UK and Ireland.

13.4.16 In terms of wider offshore wind experience, MA have delivered EIAs and post-consent work across the UK, with details available on request.

## Side Scan Sonar Data

13.4.17 Side Scan Sonar data was collected with an EdgeTech 4200 dual channel side scan sonar (SSS) system using an EdgeTech 4200FS towfish and was used to scan the seabed on either side of the ship's track using a 15 m to 75 m line spacing for geophysical sensors. The coverage was 100%. The data was recorded with Octopus 760D. Fish altitude above seabed was set to between 5% and 12% of the range operated. The frequency used was 230kHz/540kHz and 300-500 kHz & 600-900 kHz (Spectrum 1). The data was processed and analysed using Chesapeake SonarWiz software.

13.4.18 Side-scan uses a sonar device that emits conical pulses toward the sea floor via a sensor which is towed from a surface vessel (called a 'fish') or mounted on the ship's hull. The intensity of the acoustic reflections from the fish are recorded in a series of cross-track slices, which when stitched together along the direction of motion, form an image of the sea bottom within the swath (coverage width) of the beam allowing the sea floor, its textures and features to be visualised.

13.4.19 The raw data was received in Triton XTF format and post-processed in SonarWiz, imported with a 'threshold' value calculated for the specifics of the instrumentation and the environment, bottom tracked and normalised using the 'Empirical Gain Normalisation' (EGN) function.

13.4.20 The SSS data was reviewed on a line-by-line basis by a qualified MA marine archaeologist, as described in the Method Statement (RWE Renewables Ireland Ltd, 2022). All anomalies were identified and assessed for archaeological potential as per Table 4, target reports were developed and exported as ESRI shapefiles into ArcPro for synthesis with other data sets.

13.4.21 All SSS anomalies were assigned feature IDs ranging between MA2000 – MA2999.

## Echo sounder (multi-beam system) data

13.4.22 A RESON SeaBat 7125 Dual Head hull mounted multi-beam echo sounder was used to provide swath bathymetry data. The transducer frequency was 200-400 kHz with 800 beams and data was recorded using the SIS acquisition software. The survey vessel maintained an average speed of 4 knots and the angular coverage was 60-76˚. The acquired data was processed using Caris HIPS and SIPS (version 10.4) software.

13.4.23 A multibeam echosounder (MBES) is a type of sonar that is used to map the seabed using acoustic waves. Waves are emitted in a fan shape beneath its transceiver (fish) and the time it takes for the sound waves to reflect off the seabed and return to the receiver is used to calculate the water depth. MBES uses beamforming to extract directional information from the returning soundwaves, producing a swathe of depth soundings from a single ping.

13.4.24 The MBES data was received as ungridded ASCII files, and .asc grids reduced to LAT. The data was visualised using the Fledermaus 7 suite; DMagic to produce a digital terrain model (DTM) gridded at 1m according to the highest resolution xyz data received, and hillshaded. These were exported for interpretation into Fledermaus with a 32-step colour map overlaid to aid interpretation and later into ArcPro for synthesis with other data. This method allowed the processing of numerically displayed raw data into a format that was able to display the seabed terrain as a map showing the depth of the sea floor, upstanding features, and any depressions which may relate to archaeological or potentially archaeological features, debris and sites.

13.4.25 Backscatter (BS) data has also been recorded, measuring the intensity of the echo sounder pings which are assigned a grey-scale value and gridded. This provides an acoustic intensity map that is similar in appearance to SSS data, but without shadows to highlight relief. The data is useful for the interpretation of bathymetric anomalies and enables an understanding of material type for discrete features, and sediment classification of shallow deposits.

13.4.26 The MBES and BS data was reviewed by a qualified marine archaeologist for targets identified during the assessment of other datasets and information regarding the length, width and anomaly height above the seabed and was cross-referenced with side scan and sub-bottom results where these features possessed a surface expression.

13.4.27 Target imagery was captured, and feature IDs were assigned ranging between MA4000 – MA4999.

## Magnetic data

13.4.28 A Geometrics G882 marine caesium vapour magnetometer was soft towed behind the SSS and positioned using a USBL system. Resolution used was 0.1 nT[5] with a signal strength higher than 400 kHz. Flying height was set to 3 m when water depths were lower than 10 m LAT and 4 m for water depths extending 10 m LAT. The data was processed using Geosoft Oasis Montaj software.

13.4.29 A magnetometer measures magnetic fields or magnetic dipole moments and are used to measure the direction, strength, or relative change of the magnetic field of a ferrous object at a particular location, including shallow buried objects.

13.4.30 Magnetic data was assessed using GeoMetrics MagPick software package. Raw xyz profile text files were assessed on a line-by-line basis and only smoothed using low and / or high pass filters where necessary. Data was also gridded from the analytic signal to produce a spatial distribution map of anomalies. Interpreted magnetic targets were identified by combining a manual assessment of the magnetic profiles with a visual assessment of the gridded data.

[5] Measurements of the Earth's magnetic field are quoted in units of nanotesla nT

13.4.31 Magnetic anomalies greater than 5 nT have been accepted as a standard for the smallest change in magnetic field reliably detected (Dix *et al*., 2008). It has been argued that a minimum detectable deflection of 5 nT may be on the conservative side and that, where the data is relatively noise free, 3 or even 2 nT may be practical depending on noise levels, instrument type, data rate and purpose of investigation (Camidge *et al* ., 2009). Objects giving a 5 nT return from a six-metre distance are likely to be ferrous objects of around 100 kg (for example, a small anchor) (Camidge *et al*., 2009). Anomalies smaller than this are not likely to be discernible from signal noise unless passed over directly by the fish at extremely short range (c. 2m). Such signals are not expected to be of archaeological interest, constituting isolated debris or single instances of ferrous anthropogenic material.

13.4.32 The current filtering of 5 nT was deemed appropriate given the survey parameters. All magnetic targets over 5 nT were exported into ArcPro for comparative analysis with other geophysical datasets and data identified during the baseline review.

13.4.33 Correlation between magnetic targets and other datasets were based on a 50 m buffer due to the issues inherent in accurately positioning magnetic targets by their detectable magnetic field.

13.4.34 Target reports were developed for all magnetic anomalies correlating with high and medium potential side scan sonar anomalies. Feature IDs for all magnetic anomalies were assigned IDs ranging between MA5000 – MA21399.

## Sub-bottom profiler data

13.4.35 An STR Digital Sub Bottom Transmitter Massa TR-107516 hull-mounted seismic system was used to collect sub-bottom data. The transmit and receive frequency was set to 2 - 12 kHz with a record length of 60 metres. The raw data was processed using Kingdom software.

13.4.36 A sub-bottom profiler is another sonar system used in geophysical surveys of the sea floor used here to map beneath the sea floor. The sonar system is mounted to the hull of a ship and works by releasing low-frequency pulses which penetrate the surface of the sea floor and are reflected by sediments in the sub-surface. This data is used to map the sediments and sediment changes below the sea floor allowing for the identification of geological features such as volcanic ridges, underwater landslides, ancient river beds, and other features.

13.4.37 Interpretation of sub-bottom profiler data was undertaken on a line-by-line basis by a qualified marine archaeologist.

13.4.38 The data was received in SEG-Y format and imported and visualised using SonarWiz. Lines were bottom tracked and gain corrected, and then reviewed in numerical order with features digitised continuously. Features were picked by digitising reflectors and horizons of potential archaeological interest. Discrete reflectors consist of point hyperbolae and blanking effects indicative of potential buried archaeological deposits, such as wreck and debris.

13.4.39 Feature IDs for all sub-bottom anomalies were assigned IDs ranging between MA3000 – MA3999.

### Methodology geophysical data interpretation

13.4.40 The archaeological assessment of geophysical data has been undertaken by a qualified and experienced MA maritime archaeologist, as described in the Method Statement (RWE Renewables Ireland Ltd, 2022). Following delivery of the survey data as specified above the raw data has been processed and interpreted as per guidance in Marine Geophysics Data Acquisition, processing, and Interpretation (Historic England, 2013).

13.4.41 All anomalies of archaeological potential were assessed against the criteria in Table 4 and the results of the assessment of all datasets were further reviewed against the baseline data collated for the marine archaeology study area, as detailed in Section 13.5.

Table 4 Definition of archaeological categories

| Archaeological categorisation | Archaeological definition |
|---|---|
| Wreck | Known or reported wrecks and apparent shipwreck or aviation material. |
| Possible wreck or wreck debris | Features not previously recorded as wrecks or aviation, but which are considered likely to be wrecks or associated debris. |
| Anchor | Features interpreted as anchors not associated with identified wreck sites based on geophysical data including MAG, SSS and MBES. |
| **Anomalies categorisation** | |
| Archaeological anomalies | Anomalies considered to map material of archaeological significance such as buried and confirmed palaeolandscapes, as well as potential outcropping palaeolandscapes and their margins or locations where a wreck has been recorded but is not clearly defined in the geophysical datasets. All magnetic reflectors with a return over 100 nT are also included in this category. |
| Potential archaeological anomalies | Anomalies that consist of defined structural outlines or coherent material distributions with strong backscatter, or clearly upstanding objects with shadow, or pronounced scour features; or a combination of these, interpreted as of possible archaeological significance but where further investigation would be required for more detailed interpretation. |
| Geophysical anomalies | Anomalies considered to be of anthropogenic origin but likely related to modern activity with little or no archaeological significance such as modern debris, ropes, chains, or fishing gear. |

## 13.5 Assessment criteria

13.5.1 The assessment criteria for marine archaeological receptors is consistent with the EIA Methodology chapter. The criteria for determining the sensitivity of the receiving environment and the magnitude of the identified impacts on the receptors are defined in Table 5 and Table 6 respectively. For the determination of significance in EIA terms, the matrix in Table 7 has been used which shows how the combined magnitude of impact and the sensitivity of the marine archaeological receptors determines the assessment of significance of effect.

13.5.2 Impacts to marine archaeological receptors can include direct and indirect impacts. Direct impact to archaeological deposits and material (such as wrecks, aircraft, and submerged landscapes) includes disturbance or destruction of these marine archaeological receptors, through physical, chemical, or biological processes.

13.5.3 Indirect impact includes disturbance or destruction of relationships between deposits and material and their wider surroundings and may occur as a result of changes to the prevailing hydrographic regime. The effect of changes to physical processes may also include additional protection to marine archaeological receptors in terms of additional sediment cover or increased deterioration of marine archaeological receptors as a result of additional scour.

## Sensitivity of receptor criteria

13.5.4 As set out in the EIA Methodology chapter the sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if affected. Sensitivity is quantified via a consideration of its context (the receptor's adaptability, tolerance, and recoverability) and value. Table 5 sets out the criteria used in defining the sensitivity of the marine archaeological receptors. Four defined levels of sensitivity have been determined (High, Medium, Low or Negligible). Where a receptor could reasonably be assigned more than one level of sensitivity, professional judgement has been used to determine which level is applicable.

Table 5 Criteria for establishing the level of marine archaeological receptor sensitivity

| Receptor sensitivity | Definition |
|---|---|
| High | Adaptability: The receptor cannot adapt to an impact and will be substantially or irreversibly changed.<br>Tolerance: The receptor has no or a very low capacity to accommodate the proposed form of change.<br>Recoverability: The effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated.<br>Value: High importance and rarity of an international / national scale. Unique with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance.<br>Examples include; designated and non-designated heritage assets, protected wreck sites, aviation remains, palaeoenvironmental features or deposits with evidence of *in situ* finds. |
| Medium | Adaptability: The receptor has a limited capacity to adapt to an impact and may be substantially or irreversible changed.<br>Tolerance: The receptor has a very low to low capacity to accommodate the proposed form of change.<br>Recoverability: The effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated.<br>Value: Medium importance and rarity of a regional scale with limited potential for substitution. Regionally rare with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance. |

| Receptor sensitivity | Definition |
|---|---|
| | Examples include; non-designated live wreck sites, geophysical anomalies of high and medium potential, recorded wrecks not confirmed by survey, palaeoenvironmental features or deposits. |
| Low | Adaptability: The receptor is stable and has a reasonable capacity to sustain substantial or irreversible changes from an impact.<br>Tolerance: Changes to the receptor are assumed to be minor and similar to natural disintegration.<br>Recoverability: Effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated.<br>Value: Low importance and rarity, local scale. Low or no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance.<br>Examples include; fouls and obstruction, geophysical anomalies of low potential. |
| Negligible | Adaptability: The receptor has a high capacity to avoid or adapt to an impact.<br>Tolerance: Changes to the receptor cannot be distinguished from natural disintegration<br>Recoverability: Effect on the receptor is anticipated to be permanent (i.e., over 60 years) or may contribute to protection (e.g. from reburial) and irrecoverable loss is not anticipated.<br>Value: Very low to no archaeological importance and rarity, local scale. Very low or no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance.<br>Examples include; dead wrecks, dead fouls or obstructions, geophysical anomalies of negligible potential such as cables. |

## Magnitude of impact criteria

13.5.5 It is noted here that a distinction is made throughout the assessment between the magnitude, as defined by the extent, duration[6], frequency, probability[7] and consequences of the impact and the resulting significance of the 'effects' upon marine archaeological receptors. The descriptions of magnitude are specific to the assessment of marine archaeology impacts and are considered against the magnitude descriptions presented in Table 6. Potential impacts have been considered in terms of whether they are adverse or beneficial effects.

13.5.6 Where an effect could reasonably be assigned to more than one level of magnitude, professional judgement has been used to determine which level is the most appropriate for the impact. The level has been assigned based on the most appropriate potential consequences of the impact as defined for each level of magnitude (see Table 6). For example, an impact may occur constantly throughout the O&M period but is not discernible or measurable in practice, therefore it would be concluded to be of a negligible magnitude despite the frequency of the impact.

[6] Note: this is the duration of the impact and not the time taken for the receptor to recover.
[7] All impacts assessed within this EIAR chapter are considered reasonably likely to occur, and so the probability of the impact has not been a consideration in defining the magnitude of the impact.

13.5.7 . The significance of potential effects has been evaluated using a systematic approach, based upon identification of the importance / value of receptors and their sensitivity to the project activity, together with the predicted magnitude of the impact. The terms used to define receptor sensitivity and magnitude of impact are defined in the EIA Methodology Chapter and supported by the archaeologically specific criteria and guidance set out in 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), as there is currently no equivalent Irish guidance available.

13.5.8 In the assessment in Sections 13.14 to 13.17 where magnitude for impact is determined the following definitions and parameters are assumed:

- Extent – the area, the number of sites and / or the proportion of a receptor affected over which an impact occurs;
- Duration – The time for which the impact occurs;
- Frequency – how often the impact occurs;
- Probability – how likely is the impact to occur;
- Consequence – the degree of change relative to the baseline level and change in character; and
- Overall magnitude – to be assessed in line with the criteria set out in Table 6.

Table 6 Magnitude of the impact

| Magnitude | Definition |
|---|---|
| High | **Extent**: Impact across and beyond the whole receptor.<br><br>**Duration**: The impact is anticipated to be permanent (i.e., over 60 years).<br><br>**Frequency**: The impact may occur once or repeatedly throughout all project phases.<br><br>**Probability**: The impact can reasonably be expected to occur.<br><br>**Adverse consequences**: Long term substantial or irreversible and permanent change to archaeological sites, materials or the context of archaeological materials or features resulting in significant alteration of the archaeological site, feature, or materials, inhibiting interpretation of characteristics, sub-features, or components. May have impact on an international level.<br><br>**Beneficial consequences**: Large-scale enhanced understanding of the archaeological resource inversely proportional to the scale of the adverse effect, e.g., benefit through large area geophysical / geotechnical survey data released to the public domain. |
| Medium | **Extent**: Impact across and beyond the whole receptor. |

| Magnitude | Definition |
|---|---|
| | **Duration:** The impact is anticipated to be long term or permanent (i.e., over 60 years).<br><br>**Frequency**: The impact may occur once or repeatedly throughout all project phases.<br><br>**Probability**: The impact can reasonably be expected to occur.<br><br>**Adverse consequences**: Long term, permanent and clear alterations to archaeological sites, materials or the context of archaeological materials or features resulting in significant alteration of the archaeological site, feature, or materials, inhibiting interpretation of characteristics, sub-features, or components. Impact is likely to be on a local level, but loss of archaeological data may have implications on an international level.<br><br>**Beneficial consequences**: Enhanced understanding of the archaeological resource inversely proportional to the scale of the adverse effect, e.g., benefit through large area geophysical / geotechnical survey data released to the public domain. |
| Low | **Extent:** Impact across the majority and beyond the whole receptor.<br>**Duration:** The impact is anticipated to be permanent (i.e., over 60 years).<br><br>**Frequency:** The impact may occur once or repeatedly throughout all project phases.<br><br>**Probability:** The impact can reasonably be expected to occur.<br><br>**Adverse consequences:** Moderate changes to archaeological sites, materials or the context of archaeological materials or features resulting in some alteration, inhibiting interpretation of several key characteristics, sub-features, or components.<br><br>**Beneficial consequences:** Benefit to, or addition of, key characteristics, features, or elements e.g., site-specific survey and investigation leading to an enhancement of disseminated knowledge; for example, diver / ROV ground-truthing of anomalies, published results. |
| Negligible | **Extent:** No direct and / or indirect impact across or beyond the receptor is expected.<br><br>**Duration:** No duration of impact.<br><br>**Frequency:** Impact is not expected to occur.<br><br>**Probability:** The impact is not expected to occur.<br><br>**Consequences:** Changes that are indistinguishable from natural variation, do not change archaeological sites or materials and do not affect key characteristics, sub-features, or components or their environment or context. |

## Defining the significance of effect

13.5.9 The significance of the effect on marine archaeology has been determined by correlating the sensitivity of the receptor (Table 5) and the magnitude of the effect (Table 6). Effects defined as Significant, Very Significant and Profound are considered significant in EIA terms (EPA, 2022). Assessment of the significance of potential effects is detailed in Table 7.

Table 7 Significance of potential effects

| Description of Impact - Magnitude | | | Existing Environment - Sensitivity | | | |
|---|---|---|---|---|---|---|
| | | | High | Medium | Low | Negligible |
| | Adverse impact | High | Profound or Very Significant (significant) | Significant | Moderate* | Imperceptible |
| | | Medium | Significant | Moderate | Slight | Imperceptible |
| | | Low | Moderate | Slight | Slight | Imperceptible |
| | Neutral impact | Negligible | Not significant | Not significant | Not significant | Imperceptible |
| | Positive impact | Low | Moderate | Slight | Slight | Imperceptible |
| | | Medium | Significant | Moderate | Slight | Imperceptible |
| | | High | Profound or Very Significant (significant) | Significant | Moderate | Imperceptible |

*Moderate levels of effect have the potential, subject to the assessor's professional judgement, to be significant. Moderate will be considered as significant or not significant in EIA terms, depending on the sensitivity and magnitude of change factors evaluated. These evaluations are explained as part of the assessment, where they occur.

# 13.6 Receiving environment

13.6.1 The marine archaeology study area as defined in Section 13.4 encompasses the Dublin array area as well as the Offshore ECC and a 1.5 km buffer up to MHWS as illustrated in Figure 1. This area is similar to the temporary occupation area, which also encompasses a 1.5 km buffer, however the marine archaeology study area completely surrounds the array area.

13.6.2 The marine archaeology study area has been utilised in the characterisation of the receiving baseline summarised below.

13.6.3 The Marine Archaeology Technical Baseline has been prepared to provide a detailed characterisation of the receiving baseline, which together with the Archaeological Management Plan and Protocol for Archaeological Discoveries provide a comprehensive description of the marine archaeological campaigns and methods in place used to identify, protect, and mitigate impact on marine archaeological receptors.

## Environmental context

13.6.4 Dublin Array Offshore Wind Farm is located in the western Irish Sea Basin (ISB). During the Quaternary, much of Northern Europe experienced extensive ice-sheet cover during a number of glaciation events. The most recent of these glacial events was the Last Glacial Maximum (LGM), c. 34,000 BP to 12,000 BP (Clark *et al*., 2012 and Chiverrell *et al*., 2013). During this event, an ice-sheet, known as the British-Irish Ice Sheet (BIIS) merged across much of Britain and Ireland causing significant amounts of sediment to be eroded and reworked, forming variable thickness of glaciogenic deposits, referred to as 'Irish Sea Till', (Eyles and McCabe, 1989). By approximately 22,500 BP to 21,200 BP the ice had retreated to a line just south of the study areas. The ice sheet decay slowed thereafter with episodic meltwater discharge (Chiverrell *et al*., 2013) rising the relative sea level by c. 120 m globally and warming the climate. This was the beginning of the Holocene period, approximately 11,200 BP when large areas of habitable land emerged indicating that the study areas could have been terrestrial landscape as early as 11,000 BP (Sturt *et al*., 2013) through to 7500 BP (Shennan *et al*., 2008).

13.6.5 Further discussion on the environmental context following an archaeological assessment of sub-bottom survey data is included in the Marine Archaeology Technical Baseline report as well as being summarised in the palaeogeographic assessment section below.

## Maritime activity: baseline review

13.6.6 The following section provides a summary of the broad overview of human activity within the study areas and the context of the wider area. This is used to indicate the potential archaeological site types that may be encountered within the study areas. The full results of the assessments are detailed in the Marine Archaeology technical baseline report.

### Previous archaeological investigations

13.6.7 This section contains projects where archaeological investigations within the marine archaeology study area have been undertaken. The results are summarised here and detailed in the Marine Archaeology Technical Baseline report.

13.6.8 Three previous archaeological investigations have been undertaken within the marine archaeology study area, however none of these investigations produced archaeological finds (Figure 2).

13.6.9 All sites of previous archaeological investigations are further detailed in Section 3.1 and Annex A of the Marine Archaeology Technical Baseline.

## Palaeolithic (800,000-8,000 BCE), Mesolithic (8,000 - 4,000 BCE) and Neolithic (4,000 - 2,500BCE)

13.6.10 During the Palaeolithic in Ireland there is evidence of mammalian species (Monaghan, 2017) and evidence of human colonisation of Ireland has been found in the Alice and Gwendoline Cave where a brown bear patella containing butchery marks has been dated to 12,810-12,590 cal. BP (Dowd and Carden, 2016). To date there have been no finds of Palaeolithic remains reported within the marine zone of Irish waters.

13.6.11 During the Mesolithic the climate was warmer and there is increasing evidence of permanent housing structures in both Britain and Ireland (Robertson *et al*., 2013; Woodman, 1985; Waddington *et al*., 2007; Waddington and Wicks, 2017). Waterborne travel during the Mesolithic was likely undertaken in logboats or skin / hide boats (as summarised in McGrail, 2001: 172-183).

13.6.12 A Mesolithic submerged forest is located within the marine archaeology study area, (Figure 2). Samples taken dated parts of the forest to the Late Mesolithic (7,432-7,832 cal. BP), indicating that the mean sea-level at this time was -3.6 m (Mitchell, 1976).

13.6.13 During the Neolithic, communities seemingly became less mobile than those of the Mesolithic. There are no known Neolithic sites within the marine archaeology study area. However, there is evidence from the surrounding area. To the north of the marine archaeology study area, a Neolithic logboat, possibly modified with outriggers to aid long-distance sea travel, was uncovered 1 km offshore under two metres of sand during trenching for a pipeline making landfall at Gormanstown, Co. Meath (Brady, 2002).

## Bronze Age (2,500 - 800 BCE) and Iron Age (800 BCE- AD 400)

13.6.14 The Bronze Age population used routes of communication along the coasts and waterways of the region. Tin was essential in the creation of bronze materials and the closest source of tin was in Devon and Cornwall, therefore boats were essential for the movement of this resource across the Irish Sea to Ireland. Skin boats and logboats were still used throughout the Bronze Age in Ireland, however, there is evidence that logboats, such as the Lurgan boat (c. 3,900 BP), were adapted and equipped with outriggers to allow for more stability, possibly for open water journeys (Robinson *et al*., 1999).

13.6.15 The archaeological evidence for Iron Age boats in Ireland is poor. There are also no extant remains of larger sea-going vessels within Irish waters. However, evidence that they did exist in Ireland during this time comes from a gold boat model, known as the Broighter boat, found in 1896 on farmland near Limavady, Northern Ireland (Waddell, 1998). Further, several Iron Age logboats / dugouts have been found in Ireland, but not in coastal or marine contexts, such as the Lees Island 5 logboat, dated to 754-409 BCE, found in Lough Corrib, Co. Galway (Brady, 2014).

13.6.16 A smaller plank-built craft was found in 1968 in Lough Lene, Co. Westmeath. The boat has been interpreted as representing a Roman style, which indicates either the presence or knowledge of Mediterranean or northern European boat-building traditions in Ireland in the Iron Age (O'Sullivan and Breen, 2007).

## Early Medieval (AD 500 - 1100) and Medieval (1100 - 1550)

13.6.17 The Dublin Bay area was of increasing maritime importance in the early medieval period as it became more involved in the wider trading networks of northwest Europe. The bay provided a natural advantage of sheltered waters, allowing safe passage for vessels, whilst also allowing access to inland waters.

13.6.18 The archaeological finds from Dalkey Island indicate long-distance maritime activity, with Mediterranean amphorae found, as well as a large amount of E-ware pottery, a grey ware thought to originate from Western Gaul (Doyle, 1998; Loveluck and O'Sullivan, 2016).

13.6.19 Historical sources, such as Adomnan's Life of St. Columba, reference multiple Irish vessel types built and in use in the early medieval period including the early constructions of the currach and a long boat made from pine and oak timbers, but also vessels from other international traders such as the Gaulish barca or Nordic style boats (Wooding, 2002).

13.6.20 From the 10th century onwards, the Hiberno-Norse developed many ports and harbours in Ireland, including Dublin (O'Sullivan and Breen, 2007).

13.6.21 Land reclamation for Dublin's waterfront is evident from c. 900 AD where ships' timbers have been re-used. The timbers represent Nordic, clinker-built traditions while the timber was of Irish origin suggesting that boats were being built in Dublin (Wallace, 1981; McGrail, 1993).

13.6.22 During the Medieval period, the arrival of Anglo-Normans in 1169 saw the further development of Dublin Port and further effort to fortify and protect the coast through the construction of castles and mottes was undertaken.

13.6.23 While no finds of Medieval ship types such as cogs or hulks have been recovered in Irish waters, there are multiple documentary references to their usage (O'Sullivan and Breen, 2007).

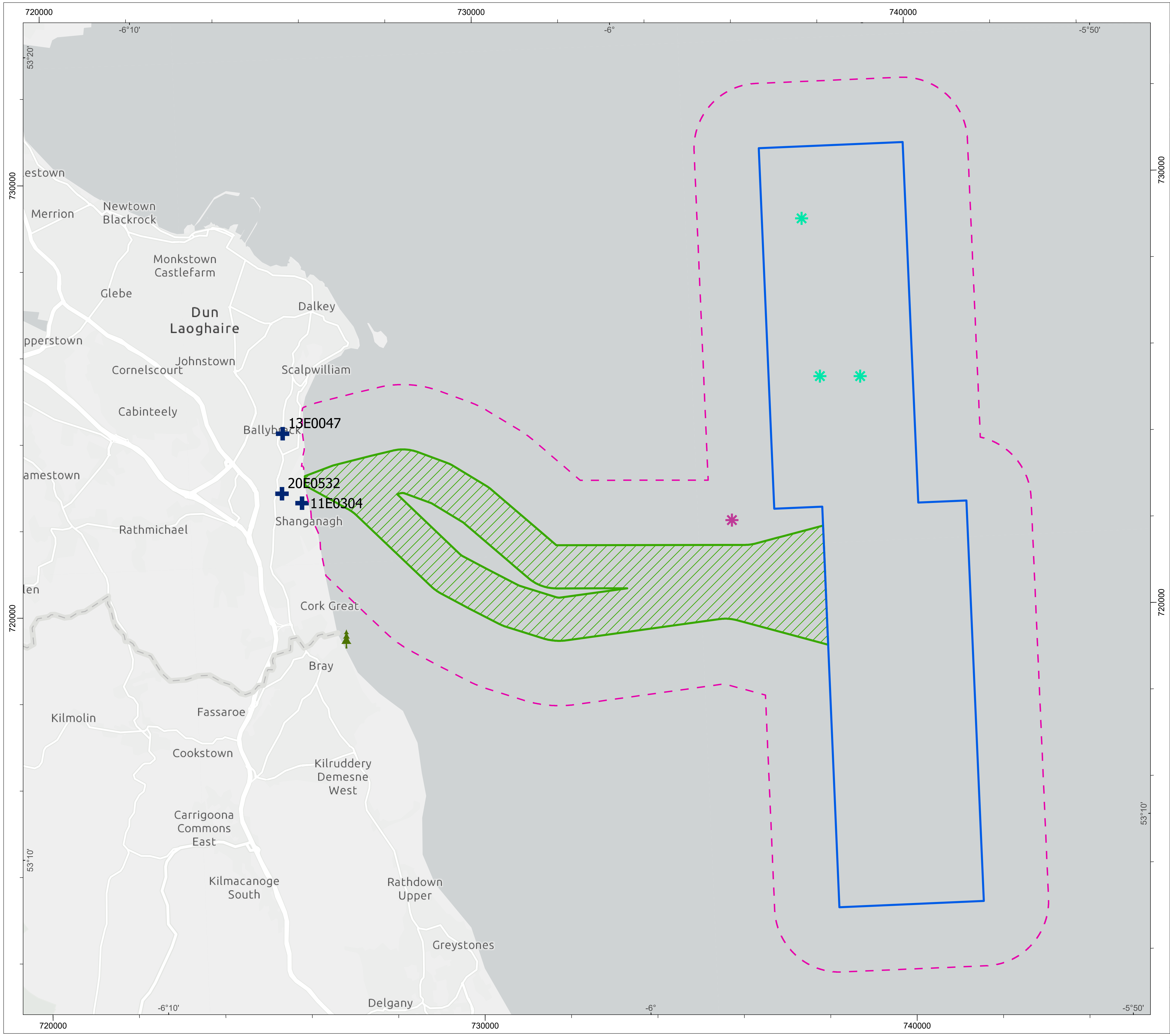
## Post-medieval (1550 onwards)

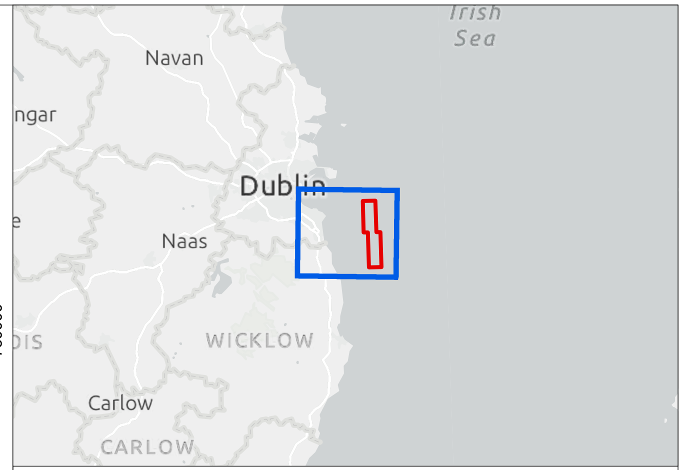
13.6.24 In the 16th century Dublin experienced an increase in trade with northern European ports. During the reign of Elizabeth I (1533-1603) the use of the first regular packet ships and boats carrying official correspondence between Dublin and Liverpool, or Chester was instigated (Gilligan, 1988).

13.6.25 The development of a safe harbour into Dublin Port and Dublin Bay saw the formation of Bull Island (Dublin City Council, 2007) and the building of substantial stone quays; the Great South Wall (1715-1730) and the North Bull Wall (1815-1823) (Dublin Port, 2019).

13.6.26 By 1804 a series of Martello towers were built down the east coast from Dublin to Wexford as a line of defences (O'Sullivan and Breen, 2007).

13.6.27 The shipping industry and traffic into Dublin Port increased significantly throughout the 19th and 20th centuries, with linen being one of the major exports (Friel, 2003). The increased shipping traffic resulted in higher numbers of wrecks, detailed further below.




- Array Area
- Export Cable Corridor
- MarineArchaeology Study Area
- Previous Archaeological Investigations
- Geotechnical Boreholes (2008)
- Vibrocore
- Submerged Forests

DRAWING STATUS

**FINAL**

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PROJECT TITLE

**Dublin Array**

DRAWING TITLE

**Previous Archaeological Investigations**

DRAWING NUMBER: 02

PAGE NUMBER: 1 of 1

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| PRJ | WGS 1984 UTM Zone 29N | | |

MARITIME ARCHAEOLOGY

DublinArray

Generation for generations

Kish Offshore Wind Limited - Bray Offshore Wind Limited

## Wrecks, aviation, and documented losses

13.6.28 Multiple datasets were used in the compilation of the baseline assessment. Where entries are included in multiple datasets, the reference number for each entry is written in bold (e.g., **W01572** or **GSI 278**) for ease of identification. Unidentified and uncharted wrecks located during geophysical investigation in 2021 have been given MA ID numbers (Figure 3).

13.6.29 There are over 3000 wrecks off the coastal waters of Dublin, listed in the WIID, however only a small percentage have been located. West of Dublin stretching ca 60 km south towards Wicklow there are over 200 wrecks listed as lost, but only a small number have been discovered to date. Because of the known use of this area prior to official records being kept there is potential for earlier, undocumented wrecks to have occurred in this area. The unknown wrecks discussed below could potentially be associated with historical documented losses within the marine archaeology study area and wider area. However, there is not enough information at present to positively identify them.

## Known wrecks

13.6.30 There are seven known wrecks within the marine archaeology study area as described below. All wrecks discussed here are also detailed in the Marine Archaeology Technical Baseline.

- The *Loch Fergus* (**W01828**) was an iron barque that ran aground in Killiney Bay, Co. Dublin on 6 February 1899;
- The *Trustful* (**W01593**) was a steam-powered fishing drifter that sank on 29 December 1924;
- The *Glenorchy* (**W01572**) was a fully rigged sailing ship. The vessel wrecked after striking the Kish Bank on 1 January 1869;
- The *Sir Charles Napier* (**W01588**) was a merchant vessel that ran aground on the Kish Bank on 19 November 1875 due to a navigation error, recorded approximately 10 m from Unknown wreck **W01629**;
- The SS *Vesper* (**W01594**) was an iron merchant steamer that wrecked on the Kish Bank on 13 January 1876, breaking in two; and
- The bow and stern sections from the MV *Bolivar* (**W09480** and **W09846**), a Norwegian motor cargo ship that ran aground in a snowstorm on 4 March 1947 off the Kish Bank and sank.

## Unknown wrecks

13.6.31 There are 36 unknown wrecks within the marine archaeology study area as summarised below (Table 8) and described in detail in the Marine Archaeology Technical Baseline report.

Table 8 Unknown wrecks within the marine archaeology study area

| MA ID | Summary | Geophysical ID |
|---|---|---|
| **W01629** | Remains of a 300 - 400 tonne wooden vessel. Discovered by Marlin Sub Aqua Club in 2003. The vessel is partially exposed on the seabed in 8 – 10 m of water. Pottery, clay pipes, iron pots, several anchors, a capstan and a winch were recorded. Recorded approximately 10 m from the wreck of *Sir Charles Napier* **W01588**. | 7. SSS: MA2126<br>8. MBES: MA4095<br>9. MAG: MA21117 |
| **W01630** | An unknown wooden wreck discovered on the Kish Bank by Marlin Sub Aqua Club in 2003. The vessel is partially exposed and upside down on the seabed. | 10. Not seen |
| **W08691** | One of six unknown wrecks on the Kish Bank detected in 2010 as part of the INFOMAR seabed mapping programme. | 11. Not seen |
| **W09300/MA01** | One of six unknown wrecks on the Kish Bank detected in 2010 as part of the INFOMAR seabed mapping programme. | 12. SSS: MA2117<br>13. MBES: MA4089<br>14. MAG: MA20528 |
| **W10276** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 15. Not seen |
| **W10297** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 16. Not seen |
| **W10597** | Recorded offshore, approximately 6 km east of Shankill, Co. Dublin. No further information is known. The status of the wreck is unknown. | 17. Not seen |
| **W11331** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 18. Not seen |
| **W11332** | One of six unknown wrecks on the Kish Bank detected in 2010 as part of the INFOMAR seabed mapping programme. | 19. SSS: MA2113<br>20. MBES: MA4087<br>21. MAG: MA20534 |
| **W11333** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 22. SSS: MA2106<br>23. MBES: MA4082 |
| **W11334** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 24. Not seen |
| **W11337** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 25. Not seen |

| MA ID | Summary | Geophysical ID |
|---|---|---|
| **W11338** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 26. Not seen |
| **W11339** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 27. Not seen |
| **W11340** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 28. Not seen |
| **W11341** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 29. Not seen |
| **W11349** | No details known. | 30. Not seen |
| **W11350** | No details known. | 31. Not seen |
| **W11360** | One of five unknown wrecks that have been recorded on the Codling Bank 700 m east of Shankill. The location is approximate and status unknown. | 32. MAG: MA13687 |
| **W11361** | One of five unknown wrecks that have been recorded on the Codling Bank 1.2 km east of Shankill. The location is approximate and status unknown. | 33. Not seen |
| **W11365** | One of five unknown wrecks that have been recorded on the Codling Bank 3 km southeast of Shankill. The location is approximate and status unknown. | 34. Not seen |
| **W11366** | One of five unknown wrecks that have been recorded on the Codling Bank 600 m east of Shankill. The location is approximate and status unknown. | 35. MAG: MA14836 |
| **W11367** | One of five unknown wrecks have been recorded on the Codling Bank 1.6 km southeast of Shankill. The location is approximate and status unknown. | 36. Not seen |
| **W11581** | One of eleven wrecks that were located on the Kish Bank, however these either have limited or no further information provided. | 37. Not seen |
| **W11610** | One of six unknown wrecks on the Kish Bank detected in 2010 as part of the INFOMAR seabed mapping programme. | 38. SSS: MA2108<br>39. MBES: MA4084 |
| **W11626** | One of six unknown wrecks on the Kish Bank detected in 2010 as part of the INFOMAR seabed mapping programme. | 40. SSS: MA2191<br>41. MBES: MA4129<br>42. MAG: MA21127 |

| MA ID | Summary | Geophysical ID |
|---|---|---|
| **W18562** | One of six unknown wrecks on the Kish Bank detected in 2010 as part of the INFOMAR seabed mapping programme. | 43. SSS: MA2117<br>44. MBES: MA4089<br>45. MAG: MA20528 |
| **GS1 278** | Located on the Kish Bank, measuring 13 x 4 m. | 46. SSS: MA2180<br>47. MBES: MA4125<br>48. MAG: MA20278 |
| **GSI 281** | No details known. | 49. Not seen |
| **GSI 285** | No details known. | 50. Not seen |

## Uncharted wrecks

13.6.32 Six uncharted wrecks were identified during geophysical surveys (Figure 3) and reported to UAU as described below.

- **MA0140** (**MA03**/GM814_contact0028): An unknown possible wreck was located during survey works by the Survey Vessel Mercator and identified by SSS (MA2139). Linear and circular reflectors are clearly visible as well as an area that seems to indicate a snagged net. The area measures 16 x 9 m and the height above seabed was measured as 0.5 m. There is also a smaller anomaly (3 x 3 m) located 46 m west of the main target represented by semi-circular hard reflectors. If the anomaly is a wreck or anthropogenic debris the material is well buried within the sandy sediments of Kish Bank. There is a magnetic return of 24 nT (MA21210) associated with this site;

- **MA0098** (**MA04**/GM771_contact0102): This possible wreck is lying in a SW - NE position and is mostly buried within the sandy sediments. There are several objects on the sea floor around the wreck associated with the vessel which might represent part of the broken hull, propulsion mechanism and a bowsprit and /or mast. The SSS (MA2097) image suggests that the wreck might be a wooden schooner. The main part of the visible hull measures 16 m, the hard reflector anomaly W of the main site is 5 m long, the linear anomaly N of the main site measures 6 m and the linear anomaly S of the main site measures 5 m. There is a magnetic return of 3645 nT (MA21060) associated with this site;

- **MA0096** (**MA05**): Substantial reflector approximately 15 m long and 5 - 6 m wide (MA2095). Scour north and south at each end shows it stands proud of the seabed. This could be a 20th century vessel. The site was marked with a buoy and suggested to be a lost container. Also measured as: length: 12 m, width: 4 m, height above seabed: 2 m;

- **MA0178** (**MA07**): Substantial anomaly in two parts measuring 21 x 6 m and 7 x 7 m. Debris on the sea floor is clearly visible on the SSS (MA2177). Reported by the survey vessel as "Possible Uncharted Wreck (seen in mag data). Clearly a large target - wreck shaped but probably broken in two associated with a large magnetic response". The wreck is located 410 m from the unknown shipwreck (**MA01**/ **W09300**) and 916 m from unknown wreck reported to UAU by a previous survey campaign (letter to Innogy Renewables Ireland Ltd, 2019), referred to in our reports as **MA02**, and 440 m from SS *Vesper* (**W01594**). There is a magnetic return of 666 nT (MA20250) associated with this site;
- **MA0171** (**MA08**): Oval shaped depression 12 x 7 m with linear hard reflectors, could possibly be wreck material or outcropping geology (MA2170). Reported as "A Possible Buried Wreck (NOT seen in mag data). Possibly wood due to the absence of a magnetic response. Overall, about 8 m in length and can be seen on sonar and MBES records". Not associated with any known wrecks; and
- **MA0134:** Isolated soft reflector; appears to be a wooden wreck or wreck debris with visible planking and sized approximately 10.8 x 5 m identified during the archaeological assessment of geophysical data. Not associated with any known wrecks.

13.6.33 A newly discovered wreck highlighted by the UAU (**MA02**) as outlined in Annex C and illustrated in Figure 3 has also been included, however **MA02** was not seen in the archaeological assessment of the geophysical data.

## Aviation archaeology

13.6.34 No aviation remains have been found within the marine archaeology study area, however historical records confirm that this area has been an active flight path since, and especially during the Second World War. Examples from Second World War aircraft finds in marine contexts can be found at Lough Erne, Northern Ireland where a Catalina flying boat was found in 2019. Unidentified anomalies as described below can potentially be associated with aviation remains.

## Documented Losses

13.6.35 Within the WIID, there are over 3000 documented losses listed off the coastal waters of County Dublin and roughly 1,500 are recorded as having wrecked within or in close proximity to the marine archaeology study area (Brady K., 2014). Examples of these wrecks include but are not limited to, 41 barques; 17 brigantines; 32 colliers; 10 ketches; 107 schooners; 78 sloops; 33 steamships; and 716 unknown vessels. The majority of documented losses within the WIID are post-1700 in date (Brady L., 2008). This is due largely to the lack of earlier written sources, and as a result, the actual number of wrecking events is expected to far exceed the current numbers.

13.6.36 The majority of wrecking events off the coast of Dublin and county Wicklow have occurred at the entrances to ports or in other shallow waters as well as on the offshore sandbanks. Within the marine archaeology study area there are seven major sandbanks which, from north to south include, Bennet, Rosbeg, Burford, Kish, Frazer, Bray, and Codling. There are also shallow areas such as the North Bull and South Bull where ships have become stranded in the past. The entrances to Dublin Bay and its harbour are a challenge to navigate due to the sandbanks which run parallel to the coast and the strong tidal currents contributing to the high number of documented losses (Lowth, 2002).

13.6.37 There are 379 records that are defined as having been lost within the general area of Dublin Bay. Furthermore, there are additional records within Dublin Bay stretching from Howth Peninsula to Dalkey Island within the marine archaeology study area that are listed with more specific locations. These current number estimates are listed below in coastline order from north to south;

- 24 recorded off Bailey Lighthouse located on the tip of Howth Peninsula;
- An additional 111 listed as lost off Howth;
- 161 records off the North Bull and three more specified as lost at Bull Wall;
- 23 records off Clontarf;
- 44 Recorded as lost off Poolbeg Lighthouse;
- 63 records on the South Bull with an additional 2 off Booterstown, and 10 off Blackrock;
- 229 documented losses off Dun Laoghaire and its harbour;
- 14 records off Sandy Cove and two off Bolluck; and
- 31 records off Dalkey and Dalkey Island with an addition 10 off the Muglins Lighthouse.

13.6.38 Within County Dublin south of Dalkey there are additional records which include 17 documented losses off Killiney and seven off Shankill.

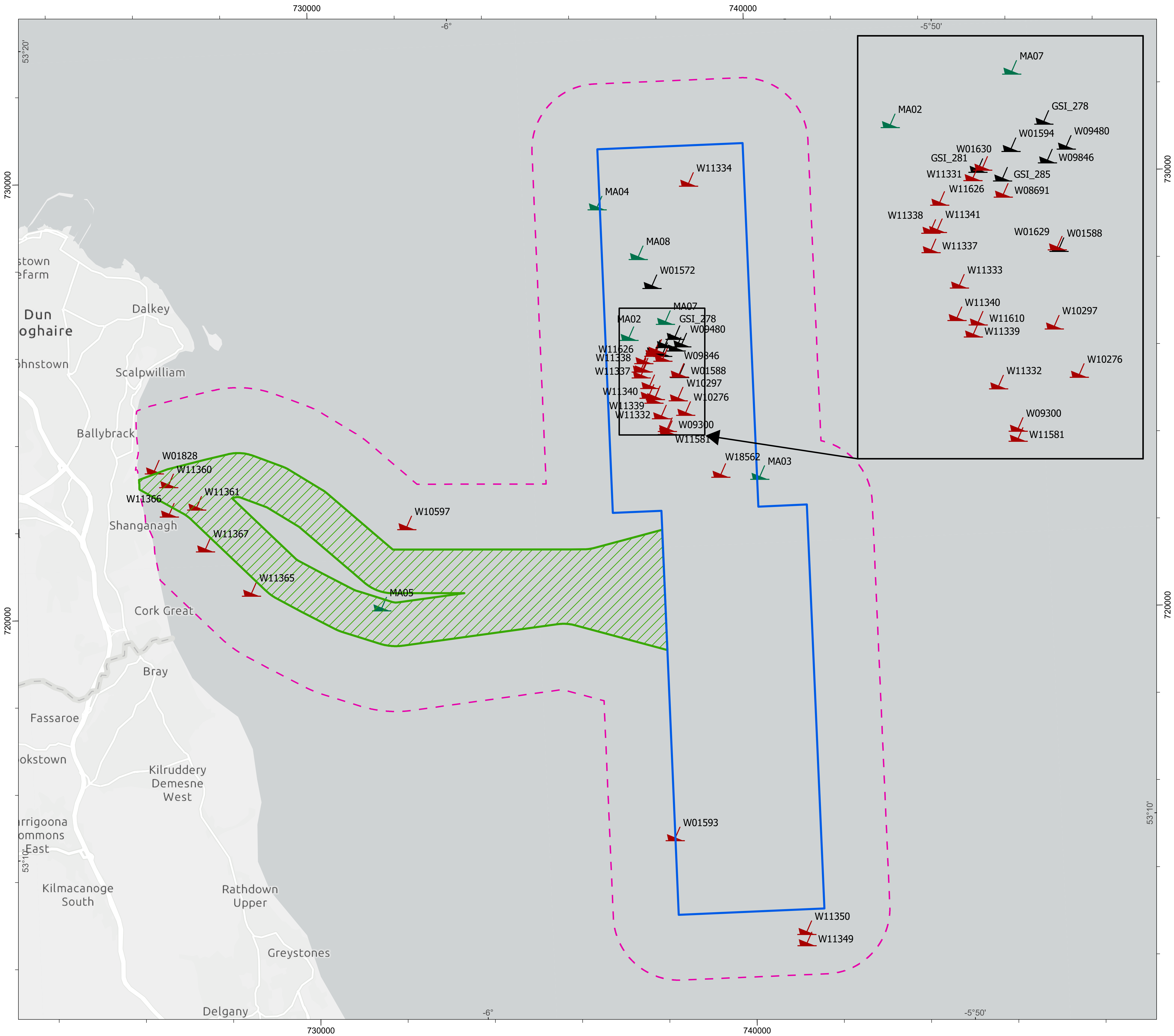
13.6.39 Along the coastline of County Wicklow (approximately within the boundary of the marine archaeology study area) from north to south documented losses are as follows;

- There are 110 recorded loses off Bray, and Bray Head;
- 34 recorded losses off Greystones;
- Seven recorded losses off Glen Strand;
- Six recorded losses off Kilcoole;
- Four recorded off Six Mile Point; and
- 14 records off Five Mile Point.

13.6.40 The sandbanks within the marine archaeology study area have been an additional cause of shipping losses. The current estimated casualties are listed below from north to south;

- Two recorded off Bennet Bank;
- Nine records on Burford Bank;
- 141 records on the Kish Bank (believed to be only half the actual number (Brady L., 2008);
- Three records on the Bray Bank; and
- 48 records off Codling Bank.

13.6.41 The unknown and uncharted wrecks outlined could potentially be associated with any of the historical documented losses within the marine archaeology study area and wider area, however, there is not enough information at present to positively relate or identify them. There is also the potential for earlier wrecks to have occurred in the study area, for which no documentation survives, and which await discovery.





Array Area
Export Cable Corridor
Marine Archaeology Study Area
Recorded wrecks
INFOMAR
MA ID
WIID

DRAWING STATUS
**FINAL**

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PROJECT TITLE
**Dublin Array**

DRAWING TITLE
**Recorded Wrecks within the Marine Archaeology Study Area**

DRAWING NUMBER: 03
PAGE NUMBER: 1 of 1

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| PRJ | WGS 1984 UTM Zone 29N | | |

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## Assessment of geophysical data

13.6.42 The archaeological assessment of geophysical data is presented below and summarised in Table 9. The archaeological categories and archaeological potential of the anomalies was determined following the criteria as stated in Table 4.

Table 9 Summary of results from the archaeological assessment of geophysical data

| Archaeological categorisation | Number of records |
|---|---|
| Wreck | 21 |
| Possible wreck or wreck debris | 16 |
| Anchor | 0 |
| **Anomalies** | |
| Archaeological anomalies | 20 |
| Potential archaeological anomalies | 41 |
| Geophysical anomalies | 7,434 |

### Wrecks

13.6.43 Twenty one records as identified from the assessment of geophysical data were classed as known or reported wrecks and apparent shipwreck or aviation material. These records have been summarised in Table 10 and further detailed in the Marine Archaeology Technical Baseline.

Table 10 Summary of geophysical targets interpreted as wrecks

| MA ID | Wreck ID | Wreck name | SSS ID | MBES ID | Mag ID |
|---|---|---|---|---|---|
| **MA0096** | MA05 | Unknown | MA2095 | MA4076 | - |
| **MA0098** | MA04 | Unknown | MA2097 | MA4078 | MA21060 |
| **MA0106** | W11626 | "Iron Pipe Wreck" | MA2105 | MA4081 | MA20526 |
| **MA0107** | W11333 | Unknown | MA2106 | MA4082 | - |
| **MA0108** | W01630/ W11331 | Unknown | MA2107 | MA4083 | - |
| **MA0110** | W11610 | Unknown | MA2109 | MA4084 | - |
| **MA0115** | W11332 | Unknown | MA2114 | MA4087 | MA20534 |
| **MA0118** | MA01/ W09300 | Unknown | MA2117 | MA4089 | MA20528 |
| **MA0120** | W01594 | SS *Vesper* | MA2119 | MA4090 | MA21101 |
| **MA0127** | W01588/ W01629 | *Sir Charles Napie* | MA2126 | MA4095 | MA21117 |

| MA ID | Wreck ID | Wreck name | SSS ID | MBES ID | Mag ID |
|---|---|---|---|---|---|
| | | r (potentially) | | | |
| **MA0132** | W11334 | Unknown | MA2131 | MA4096 | MA21288 |
| **MA0134** | - | Unknown | MA2133 | MA4097 | MA21302 |
| **MA0140** | MA03 | Unknown | MA2139 | MA4101 | MA21210 |
| **MA0171** | MA08 | Unknown | MA2170 | MA4119 | - |
| **MA0173** | W01572 | *Glenorchy* | MA2172 | MA4121 | MA20348 |
| **MA0178** | MA07 | Unknown | MA2177 | MA4123 | MA20250 |
| **MA0181** | - | Unknown | MA2180 | MA4125 | MA20278 |
| **MA0182** | W09846 | MV *Bolivar* (stern) | MA2181 | MA4126 | MA20351 |
| **MA0185** | W09480 | MV *Bolivar* (bow) | MA2184 | MA4128 | MA20195 |
| **MA0192** | W18562 | Unknown | MA2191 | MA4129 | MA21127 |
| **MA0302** | - | Uncharted | - | - | - |

## Possible wreck or wreck debris

13.6.44 16 records as identified from the assessment of geophysical data were not previously recorded as wrecks or aviation but have been considered likely to be wrecks or associated debris. These records have been summarised in Table 11 and further detailed in the Marine Archaeology Technical Baseline.

Table 11 Summary of geophysical targets interpreted as possible wreck or wreck debris

| MA ID | SSS ID | MBES ID | Mag ID |
|---|---|---|---|
| **MA0109** | MA2108 | MA4084 | - |
| **MA0111** | MA2110 | MA4085 | - |
| **MA0114** | MA2113 | MA4087 | MA20534 |
| **MA0116** | MA2115 | MA4087 | MA20534 |
| **MA0130** | MA2129 | - | MA21297 |
| **MA0136** | MA2135 | MA4098 | - |
| **MA0156** | MA2155 | MA4113 | - |
| **MA0158** | MA2157 | MA4114 | MA20535 |
| **MA0159** | MA2158 | MA4115 | MA21159 |
| **MA0160** | MA2159 | MA4116 | - |

| MA ID | SSS ID | MBES ID | Mag ID |
|---|---|---|---|
| **MA0161** | MA2160 | MA4117 | - |
| **MA0164** | MA2162 | - | - |
| **MA0176** | MA2175 | - | MA20356 |
| **MA0179** | MA2178 | MA4124 | - |
| **MA0180** | MA2179 | - | - |
| **MA0305** | - | MA4217 | MA12959 |

## Archaeological anomalies

13.6.45 Twenty anomalies have been considered to map material of archaeological significance such as buried and confirmed palaeolandscapes, or locations where a wreck has been recorded but is not clearly defined in the geophysical datasets as well as magnetic anomalies over 100 nT but with no other corresponding geophysical indication. The records have been included in the Marine Archaeology Technical Baseline, Annex C.

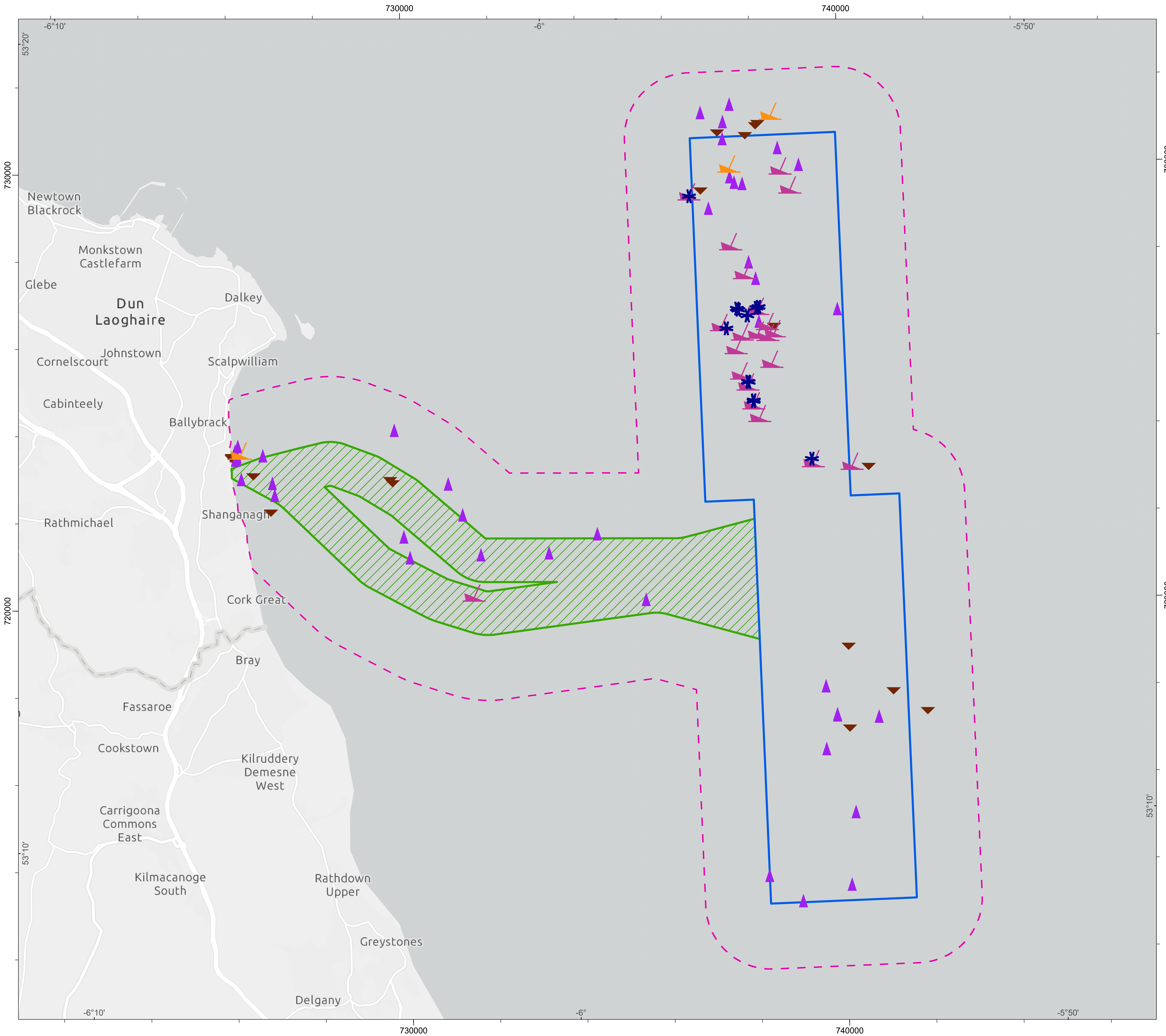
## Magnetic anomalies

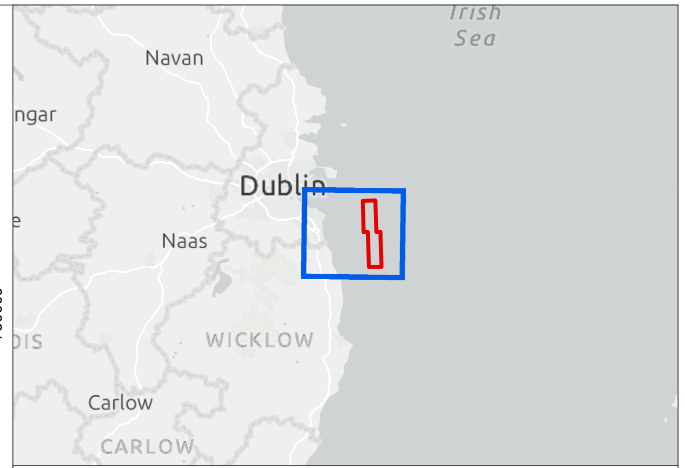
13.6.46 Forty one magnetic anomalies with a return of ≥100 nT have been considered to map material of archaeological potential, such as buried wrecks or wreck material that was not seen or clearly identified in the other geophysical datasets. Of these anomalies, 23 were identified in the MBES data but not in the SSS data, so have remained classed as magnetic anomalies due to the limited information.

13.6.47 Additionally, 7,367 targets with a return <100 nT considered to be of anthropogenic origin, but likely associated with modern activities with little to no archaeological significance, such as modern debris, ropes, chains or fishing gear and magnetic returns <100 nT with no other corresponding geophysical expression.

## Geophysical targets

13.6.48 There are 7,434 geophysical targets, including the 7,367 magnetic anomalies ,100 nT, within the marine archaeology study area. These are considered to be of anthropogenic origin but likely associated with modern activity with little or no archaeological significance such as modern debris, ropes, chains or fishing gear, and rock outcrops with no other clear anthropogenic features, which may be representative of ballast. These have been included in Marine Archaeology Technical Baseline, Annex C.




- Array Area
- Export Cable Corridor
- Marine Archaeology Study Area

Archaeological anomalies seen in geophysical data

- Archaeological anomaly
- Magnetic anomaly
- Potential Wreck
- Wreck
- Wreck Debris

DRAWING STATUS **FINAL**

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PROJECT TITLE **Dublin Array**

DRAWING TITLE **Archaeological Anomalies seen in the Geophysical Data**

DRAWING NUMBER: 04

PAGE NUMBER: 1 of 1

| VER | DATE | REMARKS | DRAW | CHEK | APRD |
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## Palaeogeographic assessment of geophysical data

13.6.49 The geoarchaeological assessment of sub-bottom data to a depth of about 5 m below the seabed was undertaken on a line-by-line basis with focus on relict palaeochannels underlaying the sea floor sediment.

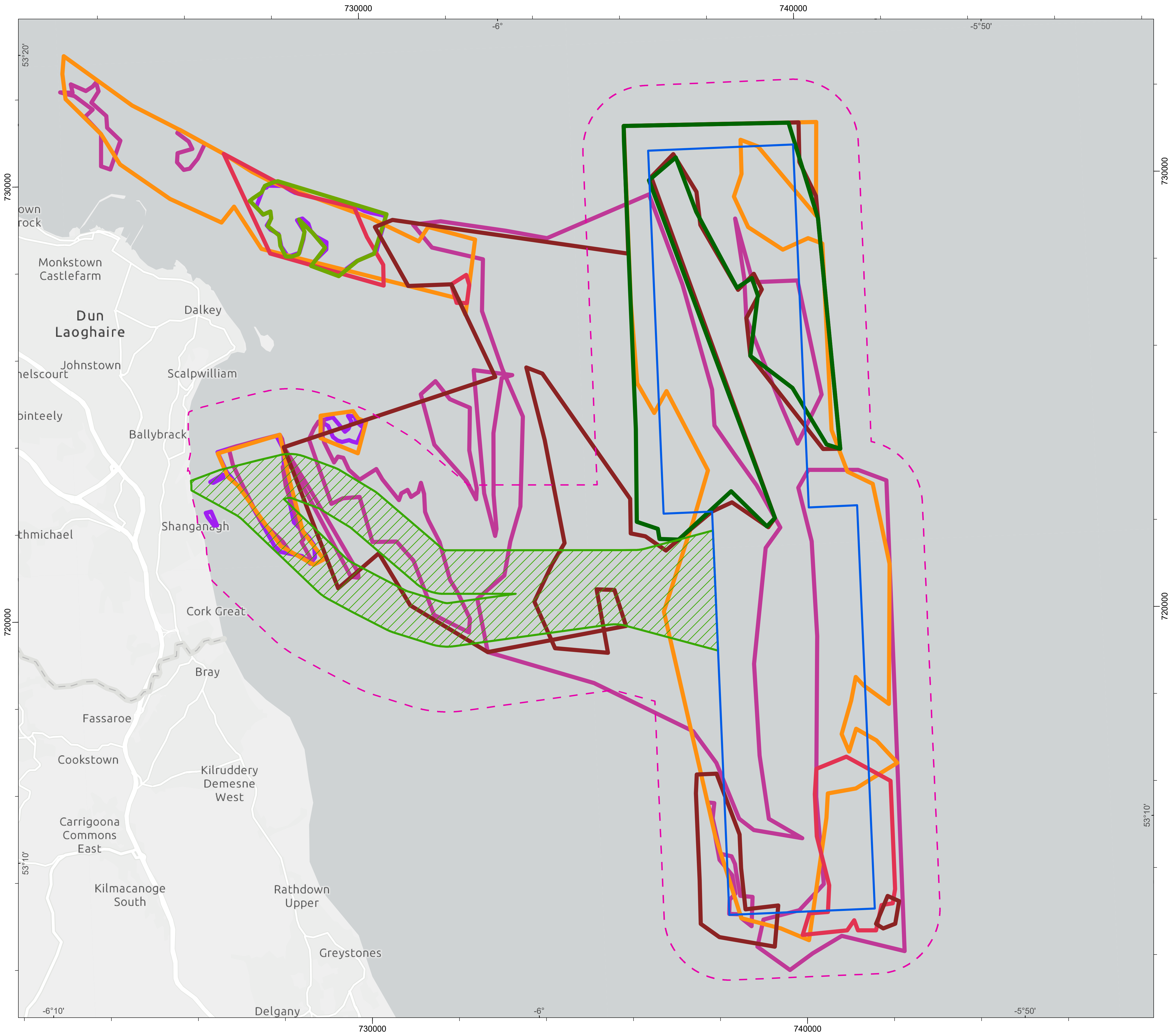
13.6.50 The results from the assessment have been based on the interpretation of both sub-bottom and UHRS data undertaken by Fugro (RWE Renewables Ireland Ltd., 2022) to provide information on the Quaternary geology.

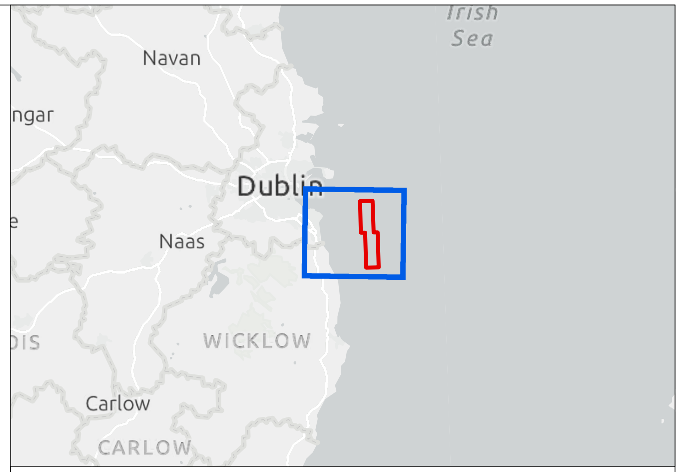
13.6.51 The units identified and their associated geoarchaeological potential are summarised in Table 12, illustrated in Figure 5 and further detailed in the Marine Archaeology Technical Baseline. The assessment has concluded that Unit B and C are of high geoarchaeological potential with Unit D of limited geoarchaeological potential but with options for further sedimental dating. The geoarchaeological potential of Units E, F and G cannot be established using the information to date, however, the Units are not likely to be contemporary with hominin presence in the area. The Quaternary deposits are underlain by Bedrock interpreted as either Mid-Tertiary sandstones or permo-Triassic mudstones which are not of further geoarchaeological potential.

Table 12 Geological units identified in the assessment of geophysical data

| Unit | Lithology | Stratigraphy | Geoarchaeological potential |
|---|---|---|---|
| **Unit A** | Mobile, unconsolidated sediments. Present across the majority of the site but mostly associated with the presence of large sandwaves and sandbanks with clear bedding in some areas. | Seabed sediment, assumed to have been deposited during the Flandrian transgression and reworked from the underlying units. | The deposit could contain archaeological artefacts but is not of geoarchaeological potential. |
| **Unit B** | Fine to medium silty SAND, medium amplitude reflectors, chaotic to sub-parallel with erosion surfaces. | Possibly subtidal to estuarine sediments deposited in the early to mid-Holocene. | Unit B of high geoarchaeological potential and could contain prehistoric human, animal, and plant material. |
| **Unit C** | Low to moderate amplitude, parallel internal reflectors with a high amplitude basal reflector. Associated with data blanking. | Interpreted as glaciolacustrine / glaciomarine prograded deposits. | High potential for the preservation of micro and macro fossils. |
| **Unit D** | SAND and GRAVEL, chaotic in places but | Complex coastal environment with | The unit is of limited archaeological |

| Unit | Lithology | Stratigraphy | Geoarchaeological potential |
| --- | --- | --- | --- |
| | well-bedded / highly structured in others. | braided glacial delta or an outwash plain. | potential due to re-working but can possibly be dated using OSL. |
| **Unit E** | Silty CLAY or silty SAND, wavy parallel, low amplitude internal reflectors. The basal reflector within the deep channel is high amplitude. | Glaciomarine/ glaciolacustrine to subglacial channel infill. | The deposit is not likely to be contemporary with hominin presence in the area. |
| **Unit F** | Chaotic – low to high amplitude internal reflector. Only seen in the UHRS data. | Subglacial till and evident channels. Likely to be glaciogenic in origin. | The deposit is not likely to be contemporary with hominin presence in the area. |
| **Unit G** | Consistent layer at base of large channels across the site, well bedded with strong internal reflectors. Only seen in the UHRS data. | Identified at the base of the deepest mapped channels below all other Quaternary units. | The deposit is not likely to be contemporary with hominin presence in the area. |
| **Bedrock** | Low to moderate to high amplitude reflector present across the site in SBP and UHRS. | Either Mid-Tertiary sandstones or permo-Triassic mudstones. | Not of geoarchaeological potential. |




- Array Area
- Export Cable Corridor
- Marine Archaeology Study Area

Units identified in the Sub-Bottom data

Unit

- Unit B
- Unit C
- Unit D
- Unit E
- Bedrock
- Shallow blanking
- Deep blanking

DRAWING STATUS

**FINAL**

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PROJECT TITLE

**Dublin Array**

DRAWING TITLE

**Units of Geoarchaeological Potential Identified in the Sub Bottom Data**

DRAWING NUMBER: 06

PAGE NUMBER: 1 of 1

| VER | DATE | REMARKS | DRAW | CHEK | APRD |
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| SCALE | 1:90,000 | PLOT SIZE | A3 |
| DATUM | WGS 1984 | VERTICAL REF | ODN/LAT/MLLW |
| PRJ | WGS 1984 UTM Zone 29N | | |

MARITIME ARCHAEOLOGY

Dublin Array

Generation for generations

Kish Offshore Wind Limited - Bray Offshore Wind Limited

## 13.7 Future baseline

13.7.1 The marine archaeology baseline assessment has been prepared to provide a detailed characterisation of the receiving environment as currently understood from the combination of baseline assessment and the analysis of geophysical data available as detailed in the Marine Archaeology Technical Baseline.

13.7.2 However, there is potential for the scientific knowledge of marine archaeology within the marine archaeology study area to develop over time. Alongside studies of existing data and newly collected data in the area ahead of other marine developments or undertaken as part of future research projects, our understanding of the baseline and identified receptors could be enhanced.

13.7.3 Further, natural changes to the environment such as sediment movements might expose and / or bury the identified receptors. Covered receptors are likely to be protected from impacts, whereas uncovered receptors may be exposed to natural and chemical degradation.

## 13.8 Do-nothing environment

13.8.1 Should Dublin Array Offshore Wind Farm not be constructed it is expected that the marine archaeological baseline will remain as detailed above.

13.8.2 However, there are a number of proposed and active infrastructure projects planned in the vicinity (see Table 36) that have potential to cause adverse, direct impact on the marine archaeological baseline or contribute with beneficial impacts, such as large-scale enhanced understanding of the archaeological resource through large area geophysical / geotechnical survey data release to public domain or the enhanced knowledge of key characteristics, features or elements, deriving from site-specific survey and investigations.

13.8.3 Generally, exposed metal and wooden wrecks and archaeological debris on the seabed would undergo slow degradation and erosion of material. Due to the naturally occurring mobile sediments in the area, shifting sands would cause archaeological anomalies to cyclically become exposed and reburied. These cycles of exposure and reburial are part of the baseline, but have the potential to be exacerbated by the installation infrastructure and development activities.

13.8.4 In the case of wrecks and archaeological features that are buried and protected from exposure, the rate of degradation would be slower than for exposed archaeological features.

## 13.9 Defining the sensitivity of the baseline

13.9.1 The sensitivity for the receptors for each potential effect, using the criteria outlined in Section 13.4, are presented in Section 13.14(construction phase of development) Section 13.15 (O&M phase) and Section 13.16 (decommissioning phase).

## 13.10 Uncertainties and technical difficulties encountered

13.10.1 There is robust data available both in terms of baseline sources outlining previous studies and archaeological sites, as well as the high-resolution geophysical data derived from the 2021 survey and the site-specific surveys undertaken both offshore and within the intertidal areas.

13.10.2 However, there are known uncertainties in identifying receptors and therefore their archaeological significance from historical records and geophysical data alone. It cannot be assumed that all receptors within the marine archaeology study area have yet been identified.

13.10.3 It is therefore important that the avoidance and preventative measures as detailed below are part of a wider campaign that ensures archaeological involvement at all project stages and that any receptors identified during the project stages are reported and investigated according to the methodologies outlined in the project's Archaeological Management Plan and current best practise.

## 13.11 Scope of the assessment

13.11.1 The impacts outlined Table 13 have been scoped in and will be assessed. No impacts have been scoped out of the assessment.

Table 13 Potential impacts identified considered within the marine archaeology assessment

| Potential impact | Impact |
|---|---|
| Construction | |
| Removal of sediment containing undisturbed marine archaeological receptors during seabed preparation for WTG and OSP foundations. | Impact 1 |
| Intrusion of piling foundations causing penetration and compression on stratigraphic contexts containing marine archaeological receptors. | Impact 2 |
| Compression of stratigraphic contexts containing marine archaeological receptors from combined weight of WTG and OSP foundation, transition piece and tower. | Impact 3 |
| Disturbance of sediment containing potential marine archaeological receptors during the laying of inter-array cables and export cable laying operations. | Impact 4 |
| Penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, OSP, or cable installation on marine archaeological receptors. | Impact 5 |
| Operation and Maintenance (O&M) | |
| Scour effects caused by the presence of WTG and OSP foundations, causing, or accelerating loss of marine archaeological receptors. | Impact 6 |
| Remedial burial of inter-array and export cables that become exposed and replacement of damaged cables. | Impact 7 |
| Penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors) on marine archaeological receptors. | Impact 8 |
| Decommissioning | |

| Potential impact | Impact |
|---|---|
| Draw-down of sediment into voids left by removed WTG and OSP foundations leading to loss of sediment, causing, or accelerating loss of marine archaeological receptors. | Impact 9 |
| Penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels on marine archaeological receptors. | Impact 10 |
| Cumulative | |
| Cumulative (inter-related) disturbance of sediment containing potential marine archaeological receptors during all phases of Dublin Array Offshore Wind Farm. | Impact 11 |

13.11.2 Project design features or avoidance and preventative measures as detailed in Table 15 will ensure that impact on marine archaeological receptors (material or contexts) will either be completely avoided through established Archaeological Exclusion Zones (AEZs) or prevented by the agreement to further assess data for archaeological potential. These commitments include measures to avoid impact of as yet undiscovered material through continued survey and the implementation of measures highlighted in the AMP, as well as those designed to protect material that is known.

## 13.12 Key parameters for assessment

13.12.1 As set out in the Application for Opinion under Section 287B of the Planning and Development Act 2000, flexibility is being sought where details or groups of details may not be confirmed at the time of the application. In summary, and as subsequently set out in the ABP Opinion on Flexibility (detailed within the EIA Methodology Chapter) the flexibility being sought relates to those details or groups of details associated with the following components (in summary - see further detail in see Volume 2, Chapter 6 Project Description (hereafter referred to as the Project Description Chapter):

- WTG (model – dimensions and number);
- OSP (dimensions);
- Array layout;
- Foundation type (WTG and OSP; types and dimensions and scour protection techniques); and
- Offshore cables (IAC and ECC; length and layout).

13.12.2 To ensure a robust and transparent assessment, and one that is compliant with the ABP Opinion on Flexibility under Section 287B, the details or groups of details associated with those components where flexibility is being sought are defined in the form of a Maximum Design Option (MDO) and alternative design option(s). The MDO and alternative design option(s) are then assessed in terms of the magnitude of the effect, to provide certainty that any option within the range of parameters will not give rise to an effect which is of greater significance than that which could occur from the MDO.

13.12.3 In addition to the details or groups of details associated with the components listed above (where flexibility is being sought), the confirmed design details and the range of normal construction practises are also assessed within the EIAR (see the Project Description Chapter). Whilst flexibility is not being sought for these elements (for which plans and particulars are not required under the Planning Regulations), the relevant parameters are also incorporated into the MDO and alternative option(s) table (Table 6, with details provided in Appendix B) to ensure that all elements of the project details are fully considered and assessed.

13.12.4 With respect to project design features where flexibility is not being sought, such as trenchless cable installation methodology at the landfall, the MDO and alternative design option(s) are the same (as there is no alternative). With respect to the range of normal construction practises that are intrinsic to installation of the development, such as the nature and extent of protection for offshore cables and the design of cable crossings, but which cannot be finally determined until after consent has been secured and detailed design is completed, the parameters relevant to the receptor being assessed are quantified, assigned and assessed as a maximum and alternative, as informed by the potential for impact upon that receptor. In the event of a favourable decision on the application they will be agreed prior to the commencement of the relevant part of the development by way of compliance with a standard 'matters of detail' planning condition (see the Policy Chapter). Throughout, an explanation and justification is provided for the MDO and alternative(s) within the relevant tables, as it relates the details or groups of details where statutory design flexibility is being sought, and wider construction practises where flexibility is provided by way of planning compliance condition.

13.12.5 Table 14 identifies the MDO and ADO of relevance to the assessment of archaeological receptors.

Table 14 Maximum and Alternative Design Options assessed

| Maximum design option | Alternative design options | Justification |
|---|---|---|
| **Construction** | | |
| **Impact 1: Removal of sediment containing undisturbed archaeological receptors during seabed preparation.** | | |
| **Dredging prior to foundation installation:**<br>Trailer suction hopper dredger (TSHD).<br>- Option B: 45 WTGs<br>- One Offshore Substation Platform (OSP) requiring seabed preparation<br><br>100% of WTGs requiring seabed preparation | **Dredging prior to foundation installation:**<br>Alternative options include the potential for fewer locations requiring seabed preparation. All seabed preparation operations of this type will take place using TSHD. Preparation for alternative foundation types and WTG options may also give rise to varying areas of seabed affected and volumes of sediment disturbed, all less than those which arise from the maximum design option<br><br>Alternative options include the potential for varying percentages of locations requiring seabed preparation. All seabed preparation operations of this type will take place using TSHD. Preparation for alternative foundation types and WTG options may also give rise to varying areas of seabed affected and volumes of sediment disturbed, all generating less SSC than the maximum design option.<br><br>An anticipated realistic alternative is for:<br>Option A: Where 17 WTGs out of 50 WTGs on monopile foundations require seabed preparation; and<br>One OSP x 100% of OSPs requiring seabed preparation | The maximum design option presents the largest seabed footprint and the greatest disturbed sediment volumes which could lead to direct or indirect impact on known marine archaeological receptors during seabed preparation.<br><br>The alternative design option presents the smallest footprint and smallest disturbed volumes from the range of WTG options.<br><br>This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option. |
| **Jack up and anchoring operations:**<br>- Option A: 50 WTGs<br>- WTG/OSP installation jack up vessel (JUV) footprint<br>- 6 jack-up operations required per turbine<br>- WTG/OSP installation of foundation vessel anchor footprints | **Jack up and anchoring operations:**<br>No alternative options have been considered for this operation, as the methodology described as the maximum design option is considered the most appropriate option. However, lower number of WTGs will reduce the number of operations and reduce the level of seabed disturbance. | |
| **IAC - Sandwave Clearance (excluding Sandbank Crossing):**<br>- Method: TSHD<br>- Maximum total length of IAC = 120 km,<br>- Up to 50% requiring seabed preparation;<br>- 40 m (maximum width of disturbance) | **IAC (excluding Sandbank Crossing)**<br>-Method: TSHD<br>- Maximum total length of IAC = 120 km,<br>- Up to 25% requiring seabed preparation;<br>- 40 m (maximum width of disturbance) | |
| **IAC Sandbank Crossing**<br>Method: Dredging using TSHD to undertake sandwave clearance across the Kish and Bray sandbanks, in two locations with three cables at each site, to allow the IAC cables to cross the sandbank.<br><br>Maximum area of seabed affected:<br>6 x 1,000 m crossings, 100% of which requiring seabed preparation. | **IAC Sandbank Crossing**<br>No alternative options have been considered for this operation, as the methodology described as the maximum design option is considered the most appropriate option. | |
| **IAC Pre-Lay Grapnel Run (PLGR):**<br>- 50 m (maximum width pre-sweeping disturbance)<br>- 120 km (maximum total length of IAC) | As for the MDO | |

| Maximum design option | Alternative design options | Justification |
| --- | --- | --- |
| **IAC Seabed preparation:**<br>- 40 m (maximum width of disturbance)<br>- 120 km (maximum total length of IACs)<br>- 50% (proportion of array cable length subject to seabed preparation<br><br>**IAC Cable installation - Ploughing:**<br>- 12 m (width of seabed disturbance)<br>- 95% of 120 km maximum total length of IAC | Alternative options for cable installation involve the potential for varying percentages of total cable lengths requiring seabed preparation than the MDO resulting in lower area of seabed disturbance.<br><br>**IAC - Cable installation:**<br>Alternative options for cable installation involve the use of different cable installation methodologies including jet trenching, rock cutting and mechanical chain excavating in addition to ploughing and MFE (which are outlined within the maximum design option).<br><br>**Method**: The alternative option will result in the smallest are of disturbance with simultaneous lay and burial (ploughing). | (See previous page) |
| **IAC Cable installation MFE:**<br>- 15 m (width of seabed disturbance)<br>- 5% of 120 km maximum total length of IAC | | |
| **Export Pre-Lay Grapnel Run:**<br>- 50 m (maximum width seabed disturbance)<br>- 18.35 km (Maximum total length of one export cable) | As for the MDO | |
| **Export cable seabed preparation:**<br>- 40 m (maximum width of seabed disturbance<br>- 18.35 km (maximum length of one export cable)<br>- 70% subject to seabed preparation)<br><br>**Export Cables**<br>Dredging using TSHD to undertake sandwave clearance<br>- Two cables;<br>- Maximum length of one export cable = 18.35 km,<br>- Up to 70% requiring seabed preparation. | **Export cable seabed preparation**<br>Alternative options for cable installation involve the potential for varying percentages of total cable lengths requiring seabed preparation than the MDO resulting in lower area of seabed disturbance.<br><br>**Export Cables**<br>Dredging using TSHD to undertake sandwave clearance<br>- Two cables<br>- Maximum length of one export cable = 18.35 km<br>- Up to 25% requiring seabed preparation | |
| **Impact 2: Intrusion of piling foundations.** | | |
| **The WTG/OSP foundation and scour protection:**<br>- Option B: 45 foundations with 4 suction feet multileg WTGs presents the largest turbine foundation footprint with scour protection;<br>- OSP maximum scour protection area for site | **WTG/OSP foundation and scour protection:**<br>Alternative foundation types and WTG options will give rise to varying areas of scour protection, all less than the maximum design option.<br>Option C: 39 WTGs with monopile foundations presents the minimum scour protection area | The maximum design option presents the largest piling footprint which could directly affect known and unknown marine archaeological receptors present within the marine archaeology study area.<br><br>The alternative design option presents the smallest piling footprint.<br><br>The maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option will not give rise to an effect which is more significant than the maximum design option. |
| **Impact 3: Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and WTG.** | | |
| Option C: 39 WTGs<br>Nacelle: maximum weight 1,200 tonnes<br>Tower: maximum weight 1,538 tonnes | Option A has the smallest maximum weight and would result in a lesser impact of compression on stratigraphic contexts. The monopile and OSP, however, remain the same. | The maximum design option presents the largest compression effects which could directly affect known and unknown marine archaeological receptors present within the marine archaeology study area.<br><br>The alternative design option presents the smallest compression effects. |
| Monopile: maximum wight (east and west) 1,250 tonnes<br>OSP: maximum weight 3,200 tonnes | The monopile and OSP, remain the same for all options. | |

| Maximum design option | Alternative design options | Justification |
|---|---|---|
| | Alternative design options may also give rise to varying areas of seabed affected, all less that the arise from the maximum design option. Details of the parameters that inform these alternative design options are provided in Annex B: Physical Processes Design Options Annex (hereafter referred to as the Physical Processes Design Options Annex) . | This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option. |
| **Impact 4: Disturbance of sediment containing potential marine archaeology receptors (material and contexts) during the laying of inter-array cables and export cable laying operations.** | | |
| **IAC Cable installation - Ploughing:**<br>- 12 m (width of seabed disturbance)<br>- 95% of 120 km maximum total length of IAC<br>The maximum total length of IAC has been identified as 120 km. Although the total length may be less than this, depending on final routeing options yet to be decided, the total value will not exceed 120 km.<br><br>**IAC Cable installation MFE:**<br>- 15 m (width of seabed disturbance)<br>- 5% of 120 km maximum total length of IAC | **IAC - Cable installation:**<br>Alternative options for cable installation involve the use of different cable installation methodologies including jet trenching, rock cutting and mechanical chain excavating in addition to ploughing and MFE (which are outlined within the maximum design option).<br><br>**Method**: The alternative option will result in the smallest are of disturbance with simultaneous lay and burial (ploughing). | The maximum design option presents the greatest disturbance of sediment containing potential marine archaeological receptors during cable operations.<br><br>The alternative design option presents the smallest disturbance of sediment containing potential marine archaeological receptors during cable operations. This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option. |
| **Export cable seabed preparation:**<br>- 40 m (maximum width of seabed disturbance<br>- 18.35 km (Maximum length of one export cable; Cable B)<br>- 70% subject to seabed preparation) | **Export cable seabed preparation**<br>Alternative options for cable installation involve the potential for varying percentages of total cable lengths requiring seabed preparation than the MDO resulting in lower area of seabed disturbance. | |
| **Export Cables**<br>Dredging using TSHD to undertake sandwave clearance<br>- Two cables;<br>- Maximum length of one export cable = 18.35 km,<br>- up to 70% requiring seabed preparation. | **Export Cables**<br>Dredging using TSHD to undertake sandwave clearance<br>- Two cables<br>- Maximum length of one export cable = 18.35 km<br>- Up to 25% requiring seabed preparation | |
| **Landfall methodology:** Trenchless installation (via HDD or direct pipe) beneath the beach, cliffs and intertidal area to be undertaken at Shanganagh. Excavation pits to be excavated and reinstated using back hoe dredge. Material will be stored to minimise loss of sediment as far as is reasonably practicable.<br><br>- Drilling punch-out location: Subtidal;<br>- Up to one per cable;<br>- Excavation pits: Up to one per cable;<br>- Maximum excavation pit dimensions: 25 m (long) x 5 m (wide) | **Landfall methodology:** Trenchless installation (via HDD or direct pipe) beneath the beach, cliffs and intertidal area to be undertaken at Shanganagh. Excavation pits to be excavated and reinstated using back hoe dredge. Material will be stored to minimise loss of sediment as far as is reasonably practicable. | |

| Maximum design option | Alternative design options | Justification |
|---|---|---|
| - Drilling punch-out location: Subtidal;<br>- One per cable (2);<br>- Excavation pits: Up to one per cable (2);<br>- Maximum excavation pit dimensions: 30 m (long) x 5 m (wide) x 2.5 m (depth);<br>- Estimated maximum excavated volume = 375 $m^3$ x 2 (number of cables) = **750 $m^3$**;<br>- Maximum length of drill = 856 m; and<br>- Maximum installation period: 40 weeks subject to suitable weather conditions, inclusive of site mobilisation and demobilisation. | No alternative options have been considered for this operation, as the methodology described as the maximum design option is considered the most appropriate option. | |
| **Use of drilling fluid (landfall): Trenchless installation**<br>The drilling fluid is anticipated to be a low concentration bentonite/water mixture.<br><br>Drill exit head to will stop short of punch out, flush bentonite, and complete the final 10 m in order to mitigate bentonite release on punch out.<br><br>For the purposes of the assessment this is assumed to be an instantaneous release as this is the most conservative assumption for the purposes of the study/assessment model. | No alternative options have been considered for this operation, as the methodology described as the maximum design option is considered the most appropriate option. | |
| **Impact 5: Penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, sub-station, or cable installation.** | | |
| Combined area of jack-up vessel legs during installation **1,650 $m^2$**.<br>Impacted volume of all anchors used during the installation phase at WTG **3,686 $m^3$**.<br>Impacted volume of all anchors used during the installation phase of the Export Cable **345,876 $m^3$**.<br>Impacted volume of all anchors used during the installation phase of the Array Cable **56,552,727 $m^3$**. | No alternative options have been considered for this operation, as the methodology described as the maximum design option is considered the most appropriate option. However, a lower number of WTGs will reduce the number of operations and reduce the level of seabed disturbance.<br><br>Details of the parameters that inform these alternative design options are provided in the Physical Processes Design Options Annex. | The maximum design option presents the greatest penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, OSP, or cable installation.<br><br>This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option. |
| **Operation and Maintenance** | | |
| **Impact 6: Scour effects caused by the presence of WTG and substation foundations, causing, or accelerating loss of the receptor.** | | |
| **Lifetime of the proposed development:** 35 years (operating life) | **Lifetime of the proposed development:** 35 years (operating life) | This scenario results in the greatest disturbed seabed volumes which can result in scour which could lead to indirect impact on known marine archaeological receptors. |

| Maximum design option | Alternative design options | Justification |
|---|---|---|
| **The WTG/OSP foundation and scour protection:**<br>- Option B: 45 foundations with 4 suction feet multileg WTGs presents the largest turbine foundation footprint with scour protection;<br>- OSP maximum scour protection area for site | **WTG/OSP foundation and scour protection:**<br>Alternative foundation types and WTG options will give rise to varying areas of scour protection, all less than the maximum design option.<br>Option C: 39 WTGs with monopile foundations presents the minimum scour protection area | This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option. |
| **Impact 7: Remedial burial of inter-array and export cables that become exposed and replacement of damaged cables.** | | |
| **Lifetime of the proposed development:** 35 years (operating life) | **Lifetime of the proposed development:** 35 years (operating life) | The maximum design option presents the greatest disturbance to the seabed due to cable protection measures.<br><br>The alternative design option presents the smallest disturbance to the seabed due to cable protection measures.<br>This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option. |
| **IAC cable protection**<br>Cable protection measures secured to the seabed if considered necessary and subject to license approval;<br>- Length of IAC cable requiring additional protection where optimum burial is not achieved = 24.6 km;<br>- Total footprint of all IAC cable crossings includes footprint of the berm and mattresses x two crossings. | **Cable protection:**<br>Cable protection measures may not be required at any location, if the desired burial depth is achieved at all points. This approach would represent the design option with the minimum scale of effect. Alternative options include the potential for varying percentages of the cable routes to require cable protection, ranging from 0% up to that assessed as the maximum design option.<br><br>Alternative options for cable crossings include the use of concrete mattresses placed in isolation, rather than in addition to rock berms as in the maximum design option. | |
| **Export cable protection:**<br>- Maximum footprint of cable protection = 12 km (up to 6km per cable)<br>- Total footprint of all export cable crossings includes footprint of the berm and mattresses x six crossings<br><br>**Cable crossings**<br>- Assumes a maximum of two cable crossings of Dublin Array cables;<br>- Assumed to be constructed of both concrete mattresses (six per crossing) and rock berm<br><br>**Cable Repairs:**<br>- Methodology: remedial burial of cables including rock dumping and / or concrete mattress installation/rock bags installation;<br>- Array and ECC cable repairs 600m (length repaired) x 10 m (trench width) x<br>- 7 (events/lifetime)<br>Array and ECC cable remedial reburial 10 km (length reburied)<br>- x 5 (reburial events/lifetime)<br>Array and ECC cable repairs will be 2000m x 10 m (trench width)<br>- x7 (repairs/lifetime) | **Export cable protection:**<br>The alternative option involves no cable protection required;<br>Cable protection measures may not be required at any location, if the desired depth of cover is achieved at all points. This approach would represent the design option with the minimum scale of effect. Alternative options include the potential for varying percentages of the cable routes to require cable protection, ranging from 0% up to that assessed as the maximum design option<br><br>**Cable crossings:**<br>Alternative options for cable crossings include the use of concrete mattresses placed in isolation, rather than in addition to rock berms as in the maximum design option.<br><br>**Cable repairs:**<br>Method: Jetting tools potentially followed by rock dumping and / or concrete mattress installation<br>Remedial burial of cables: 10 km per event;<br>x 3 reburial events assumed over the project lifetime;<br>Array and ECC cable repairs will be 600 m (cable length of repair) x 10 m (trench width)<br>-x 4 (repairs/lifetime) | |
| **Impact 8: Penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors).** | | |
| **Jack-up Vessel (JUV) activities**<br>- Maintenance JUV footprint<br>- Option A: 50 WTGs<br>- 3 jack-up operations per WTG and 1 OSP<br><br>Combined area of jack-up vessel legs during operation and maintenance **1,650 m$^2$**. | Alternative options for the use of jack-up vessels and maintenance activities involve the requirement for fewer maintenance events to be required over the lifetime of the Project | The maximum design option presents the greatest penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors).<br>This maximum design option leads to the greatest potential for impact and informs the subsequent detailed assessment. The alternative design option (or any other option within the range of parameters set out in the project |

| Maximum design option | Alternative design options | Justification |
|---|---|---|
| Impacted volume of all anchors used during the installation phase at WTG **3,686 $m^3$**.<br>Impacted volume of all anchors used during the installation phase of the Export Cable **345,876 $m^3$**.<br>Impacted volume of all anchors used during the installation phase of the Array Cable **56,552,727 $m^3$**. | | description) will not give rise to an effect which is more significant than the maximum design option. |
| **Decommissioning** | | |
| **Impact 9: Draw-down of sediment into voids left by removed WTG foundations leading to loss of sediment, causing, or accelerating loss of the receptor.** | | |
| Removal of structures is expected to be undertaken as an approximate reverse of the installation process;<br>- It is anticipated that piled foundations will be cut at a level just below the seabed;<br>- Buried cables to be cut and left in situ (but to be determined in consultation with key stakeholders as part of the decommissioning plan and following best practice at the time of decommissioning);<br>- Scour and cable protection left in situ; and<br>- Decommissioning activities lasting approximately three years for both onshore and offshore works.<br>**Removal of foundations:**<br>- 50 WTGs; and<br>- One OSP.<br>- Landfall infrastructure will be left in situ where considered appropriate. Any requirements for decommissioning at the landfall will be agreed with statutory consultees; and<br>- It is likely judged that cable removal will bring about further environmental impacts. At present it is therefore proposed that the cables will be left in situ, but this will be reviewed over the design life of the project. | Decommissioning activities are expected to be the same for all design options. Alternative design options are represented by varying numbers of total structures within the array area (represented by different WTG options), as shown below.<br>**Removal of foundations:**<br>- Option C: 39 WTGs and Option B: 45 WTGs; and<br>- One OSP.<br>As for the MDO Landfall infrastructure will be left in situ where considered appropriate. Any requirements for decommissioning at the landfall will be agreed with statutory consultees; and<br>- It is likely judged that cable removal will bring about further environmental impacts. At present it is therefore proposed that the cables will be left in situ, but this will be reviewed over the design life of the project. | The MDO is the option with the greatest number of WTGs (Option A: 50 WTGs). All alternatives have lower potential for damage to assets and infrastructure during decommissioning. |
| **Impact 10: Penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels.** | | |
| As above. See Impact 9: Draw-down of sediment into voids left by removed WTG and OSP foundations leading to loss of sediment, causing, or accelerating loss of marine archaeological receptors. | | |

# 13.13 Project Design Features and Avoidance and Preventative Measures

13.13.1 As outlined within the EIA Methodology Chapter and in accordance with the EPA Guidelines (2022), this EIAR describes the following:

- Project Design Features: These are features of the Dublin Array project that were selected as part of the iterative design process, which are demonstrated to avoid and prevent significant adverse effects on the environment in relation to marine archaeological receptors. These are presented within Table 15.

- Other Avoidance and Preventative Measures: These are measures that were identified throughout the early development phase of the Dublin Array project, also to avoid and prevent likely significant effects, which go beyond design features. These measures were incorporated in as constituent elements of the project, they are referenced in the Project Description Chapter of this EIAR and they form part of the project for which the Planning Application is being sought. These measures are distinct from design features and are found within our suite of management plans. These are also presented within Table 15.

- Additional Mitigation: These are measures that were introduced to the Dublin Array project after a likely significant effect was identified during the EIA assessment process. These measures either mitigate against the identified significant adverse effect or reduce the significance of the residual effect on the environment. The assessment of impacts is presented in Sections 13.14, 13.15 and 13.16 of this EIAR chapter.

13.13.2 All measures are secured within Volume 8, Chapter 2: Schedule of Commitments.

13.13.3 The commitments are based on guidance outlined in the Framework and Principles for the Protection of Archaeological Heritage (DAHGI, 1999a) and the Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021). Various archaeological Codes of Practice from onshore development were also consulted, including the most recent reference, Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Rural and Gaeltacht Affair (now named Minister for Tourism, Culture, Arts, Gaeltacht, Sport and Media) and Transport Infrastructure Ireland (Transport Infrastructure Ireland, 2017). In addition, throughout the preparation of this EIAR, there has been ongoing consultation between the Applicant and the UAU to discuss approaches to mitigation and potential mitigation measures to be proposed within the AMP. The design of the project is iterative and the commitments to mitigation are standard in reflecting both the guidance above and the ongoing consultation, but may also be updated throughout the life of the project to reflect the best practice.

13.13.4 The mitigation measures outlined in Table 15 have been set out so that the project design and implementation will have regard to the archaeological potential and archaeological significance across the array area and Offshore ECC and eliminate or reduce associated impacts. Continued investigation through survey and the specifications for investigation and reporting set out in the AMP and Protocol for Archaeological Discoveries (PAD) documents, respectively, work to embed these mitigation measures for use throughout the life of the project.

Table 15 Project design feature/other avoidance and preventative measures relating to marine archaeology

| Project design feature/other avoidance and preventative measures | Where secured |
|---|---|
| Licenses will be obtained under the National Monuments Acts 1930-2014 for all relevant geotechnical surveys, archaeological dive surveys, ROV surveys, hand-held metal detection surveys and intertidal surveys. Results will be assessed and reported by a suitably qualified archaeologist. | Outlined in the Project Description |
| Measures to avoid impact on known archaeological receptors include:<br>51. Compliance with Underwater Archaeology Unit Guidelines;<br>52. Implementation of archaeological exclusion zones; Liaison with DHLGH through circulation of full method statement;<br>53. If required material will be moved or removed from the seabed, a watching brief (undertaken by an appropriately qualified and approved archaeologist) | All measures outlined within the Archaeology Management Plan in compliance with National Monuments (amendment) Act 1987) and designed with consultation with the UAU |
| Measures to prevent impact on unknown archaeological receptors include:<br>54. Protocol for Archaeological Discovery ;<br>55. Geoarchaeological assessment of deposits of archaeological potential, following an approved method statement will be undertaken, results will be assessed and reported by a suitably qualified archaeologist.<br>56. If required material will be moved or removed from the seabed, a watching brief (undertaken by an appropriately qualified and approved archaeologist) | All measures outlined within the Archaeology Management Plan in compliance with National Monuments (Amendment) Act 1987) and designed with consultation with the UAU |
| Any surveys will be licensed under the National Monuments Acts 1930-2014 and the results will be assessed and reported by a suitably qualified archaeologist. | The project description outlines the requirement for pre and post construction surveys with the AMP outlining requirements for archaeological licences. |

## 13.14 Environmental Assessment: Construction phase

13.14.1 A description of the significance of effects of the construction phase of the offshore infrastructure within the marine archaeology study area is provided below.

13.14.2 The assessment considers the potential impacts as listed in Table 13 along with design options for each construction impact (Table 14) and the assessed impact following the implementation of the project design features and avoidance and preventative measures Table 15).

### Application of avoidance and preventative measures

13.14.3 The avoidance and preventative measures as outlined in Table 15 will ensure that: all surveys will be licensed under the National Monuments Acts 1930-2014; unknown marine archaeological receptors are located and identified; and known marine archaeological receptors are avoided and / or further investigated.

13.14.4 Surveys conducted prior to any works occurring will be carried out in compliance with the UAU guidelines. The data from these surveys will be assessed and used to identify locations of known and potential marine archaeological receptors. The results will contribute to an increased understanding of the locations on the seabed of potential and confirmed receptors which will be avoided by established AEZs.

13.14.5 AEZs will be implemented around known and identified potential sites of archaeological interest. All activities interfering with the seabed during the construction phase will be micro sited to avoid these AEZs.

13.14.6 A clear understanding of the responsibilities and commitments of all parties involved in any construction works will be ensured through the strategies laid out in the project's AMP and work-specific methods statements.

13.14.7 Unexpected, unconfirmed, and unknown receptors will be reported via the PAD system when an archaeologist is not present onboard and will be recommended AEZs or further archaeological work as per the project's AMP.

13.14.8 An archaeological assessment will occur and the DCHG will be consulted should any project activities that may be necessary within established AEZs prior to any work commencing, and a method statement detailing any planned developmental and archaeological works will be produced.

13.14.9 Watching briefs will be undertaken where relevant if impact to marine archaeological receptors is anticipated during intrusive activities or if material will be moved or removed from the seabed.

13.14.10 Anomalies of archaeological potential and / or interest will be investigated where possible during the life of the project to contribute to the understanding of the marine archaeological environment.

## Impact 1: Removal of sediment containing undisturbed archaeological receptors during seabed preparation.

13.14.11 Removal of sediment during seabed preparations (including sandwave clearance) can lead to direct and / or indirect impacts on marine archaeological receptors by exposing such material to natural, chemical, or biological processes.

13.14.12 If any marine archaeological receptors are subject to increased sediment cover due to deposition of sediment, as a result of the construction phase activities, the receptor is likely to benefit from conditions which could provide a higher level of preservation *in situ*.

13.14.13 This assessment should therefore be read in conjunction with the Physical Processes Chapter and the Physical Processes Technical Baseline, which provide a full description of the offshore physical environment assessment (including project specific modelling of sediment plume dynamics).

13.14.14 The magnitude of Impact 1 is based on the definition shown in Table 6. The assessment in Table 16 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12.

13.14.15 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 17.

Table 16 Determination of magnitude for removal of sediment containing undisturbed and unknown archaeological receptors during seabed preparation

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of sediment removal during seabed preparation during construction activities may range from across and beyond the whole receptor to having no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment removed will be less. |
| Duration | The impact on marine archaeological contexts disturbed by sediment removal during seabed preparation activities is anticipated to be permanent. | In line with the maximum design option. |
| Frequency | The impact on marine archaeological contexts disturbed by sediment removal during seabed preparation activities may occur once or repeatedly. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact on marine archaeological contexts disturbed by sediment removal during seabed preparation activities is likely to occur. | In line with the maximum design option. |

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Consequence | The impact on marine archaeological contexts disturbed by sediment removal during seabed preparation activities may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of sediment removed will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 17 Determination of sensitivity of marine archaeological receptors to the removal of sediment containing undisturbed archaeological contexts during seabed preparation

| Receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of removal of sediment during seabed preparation and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate disturbance caused by sediment removal.<br>**Recoverability:**<br>The effect on marine archaeological receptors is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors present within the marine archaeology study area may range from unique to having no recognised value with regards to factors including period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.14.16 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.14.17 The magnitude of impact from removal of sediment during seabed preparation activities (shown in Table 14) with assumption of avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.14.18 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

### Residual effect assessment

13.14.19 Following the utilisation of all avoidance and preventative measures , it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.14.20 The significance of effect is therefore **Not Significant**, in EIA terms.

13.14.21 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of removal of sediment containing undisturbed archaeological contexts during seabed preparation.

## Impact 2: Intrusion of piling foundations.

13.14.22 Intrusion of piling foundations can lead to direct impact on marine archaeological receptors through penetration and / or compression of stratigraphic contexts containing marine archaeological receptors.

13.14.23 Impacts from penetration and compression can result in total or partial loss of marine archaeological receptors contained in the sediments below the installed infrastructure.

13.14.24 The magnitude of Impact 2 is based on the definition shown in Table 6. The assessment in Table 18 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12.

13.14.25 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 19.

Table 18 Determination of magnitude of intrusion of piling foundations

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of penetration and compression on stratigraphic contexts containing archaeological material may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment impacted will be less. |

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Duration | The impact of penetration and compression on stratigraphic contexts due to piling foundations is anticipated to be permanent. | In line with the maximum design option. |
| Frequency | The impact of penetration and compression on stratigraphic contexts due to piling foundations may occur once or repeatedly. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact on marine archaeological receptors from penetration and compression on stratigraphic contexts due to piling foundations is likely to occur. | In line with the maximum design option. |
| Consequence | The impact on marine archaeological receptors from penetration and compression by piling foundations may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option impacts may range in their impact on the receptor, however the volume of sediment impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 19 Determination of sensitivity of marine archaeological receptors to intrusion of piling foundations

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of compression and penetration of piling foundations and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate impact from penetration or compression.<br>**Recoverability:**<br>The effect on marine archaeological receptors is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |

| Marine archaeological receptor | Justification |
|---|---|
| Value | Marine archaeological receptors may range from unique to no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.14.26 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.14.27 The magnitude of impact with assumption of implementation of avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.14.28 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

### Residual effect assessment

13.14.29 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.14.30 The significance of effect is therefore **Not Significant**, in EIA terms.

13.14.31 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of intrusion of piling foundations.

## Impact 3: Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and WTG.

13.14.32 Compression of stratigraphic contexts containing marine archaeological receptors from the combined weight of WTG and OSP foundation, transition piece, tower and other infrastructure can lead to direct impact on marine archaeological receptors.

13.14.33 Impacts from compression can result in total or partial loss of marine archaeological receptors contained in the sediments below the installed infrastructure.

13.14.34 The magnitude of Impact 3 is based on the definition shown in Table 6. The assessment in Table 20 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.11.2.

13.14.35 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and is assessed in Table 21.

Table 20 Determination of magnitude for compression of stratigraphic contexts containing marine archaeological material from combined weight of foundation, transition piece, tower and WTG

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of compression of stratigraphic contexts from the combined weight of WTG and OSP infrastructure may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option , impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of impact will be less. |
| Duration | The impact on marine archaeological contexts from the combined weight of WTG and OSP infrastructure is anticipated to be permanent. | In line with the maximum design option. |
| Frequency | The impact on marine archaeological contexts impacted by the combined weight of WTG and OSP infrastructure may occur once or repeatedly. | In line with the maximum design option, however the impact will occur over fewer locations and therefore less frequently. |
| Probability | The impact on marine archaeological contexts from the combined weight of WTG and OSP infrastructure is likely to occur. | In line with the maximum design option. |
| Consequence | The impact on marine archaeological contexts from the combined weight of WTG and OSP infrastructure may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the area impacted will be lesser. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 21 Determination of sensitivity of marine archaeological receptors to compression of stratigraphic contexts from combined weight of foundation, transition piece, tower and WTG

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of compression due to the combined weight of WTG and OSP infrastructure and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate impacts from compression.<br>**Recoverability:**<br>The effect on marine archaeological receptors is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | The potential sensitivity of marine archaeological receptors is rated as **High**. |

13.14.36 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.14.37 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.14.38 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

## Residual effect assessment

13.14.39 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.14.40 The significance of effect is therefore **Not Significant**, in EIA terms.

13.14.41 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of compression of stratigraphic contexts containing archaeological material from the combined weight of foundation, transition piece, tower and WTG.

## Impact 4: Disturbance of sediment containing potential marine archaeology receptors (material and contexts) during the laying of inter-array cables and export cable laying operations.

13.14.42 Disturbance of sediment containing potential marine archaeological receptors (material and contexts) during the laying of inter-array cables and export cable laying operations can lead to direct and / or indirect impacts on marine archaeological receptors by impacting and exposing such receptors to natural, chemical, or biological processes.

13.14.43 If any marine archaeological receptors are subject to an increase in sediment cover and protection as a result of the construction phase, the marine archaeological receptor might benefit from the conditions which could provide a higher level of preservation *in situ*. However, exposure of sites and receptors due to sediment movement may lead to the partial or total loss of the same.

13.14.44 This assessment should therefore be read in conjunction with the Physical Process Chapter (where the maximum extent of potential sediment plumes are presented explicitly in Sections 1.12 to 1.15 therein) and the Physical Processes technical baseline which provide a full description of the offshore physical environment assessment (including project specific modelling of sediment plume dynamics).

13.14.45 The magnitude of Impact 4 is based on the definition shown in Table 6. The assessment in Table 22 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.1213.11.2.

13.14.46 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 23.

Table 22 Determination of magnitude for disturbance of sediment containing potential marine archaeological receptors during the laying of inter-array cables and export cable laying operations

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of disturbance of sediment containing archaeological receptors during cable laying operations may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment disturbed will be less. |
| Duration | The impact on marine archaeological contexts disturbed | In line with the maximum design option. |

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| | during cable laying operations is anticipated to be permanent. | |
| Frequency | The impact on marine archaeological contexts disturbed during cable laying operations may occur once or repeatedly. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact on marine archaeological contexts disturbed by cable laying operations is likely to occur. | In line with the maximum design option. |
| Consequence | The impact on marine archaeological contexts disturbed during cable laying operations may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of sediment impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 23 Determination of sensitivity of marine archaeological receptors to disturbance of sediment during inter-array cables and export cable laying operations

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of disturbance of sediment during cable laying operations and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate the proposed form of change.<br>**Recoverability:**<br>The effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine |

| Marine archaeological receptor | Justification |
|---|---|
| | archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.14.47 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.14.48 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.14.49 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

### Residual effect assessment

13.14.50 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.14.51 The significance of effect is therefore **Not Significant**, in EIA terms.

13.14.52 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of disturbance of sediment containing potential marine archaeological receptors (material and contexts) during inter-array cables and export cable laying operations.

## Impact 5: Penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, sub-station, or cable installation.

13.14.53 Penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, OSP, or cable installation can lead to direct impact on marine archaeological receptors.

13.14.54 Impacts from penetration and compression can result in total or partial loss of marine archaeological receptors contained in the sediments below the vessels, anchors or infrastructure.

13.14.55 The magnitude of Impact 5 is based on the definition shown in Table 6. The assessment in Table 24 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.4.

13.14.56 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 25.

Table 24 Determination of magnitude of penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, substation, or cable installation

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of penetration and compression effects from construction vessels may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment impacted will be less. |
| Duration | The impact of penetration and compression effects from construction vessels is anticipated to be permanent. | In line with the maximum design option. |
| Frequency | The impact on marine archaeological contexts impacted by compression and penetration effects caused by construction vessels may occur once or repeatedly. | In line with maximum design option, however, will occur less frequently. |
| Probability | The impact on marine archaeological contexts impacted by compression and penetration effects caused by construction vessels is likely to occur. | In line with the maximum design option. |
| Consequence | May range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of sediment impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 25 Determination of sensitivity of marine archaeological receptors to penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, substation, or cable installation

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of compression and penetration caused by construction vessels and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate impact from compression and penetration effects.<br>**Recoverability:**<br>The effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to having no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.14.57 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.14.58 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.14.59 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

## Residual effect assessment

13.14.60 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.14.61 The significance of effect is therefore **Not Significant**, in EIA terms.

13.14.62 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of penetration and compression effects of jack-up barges and anchoring of construction vessels during WTG, substation, or cable installation.

# 13.15 Environmental assessment: operational phase

13.15.1 A description of the significance of effects of the operational phase of Dublin Array Offshore Wind Farm within the marine archaeology study area is provided below. The assessment considers the potential impacts as listed in Table 13, along with design options for each construction impact (Table 14).

## Application of avoidance and preventative measures

13.15.2 The implementation of the avoidance and preventative measures as outlined in Table 15 will ensure that: all surveys will be licensed under the National Monuments Acts 1930-2014; unknown marine archaeological receptors are located and identified; and known marine archaeological receptors are avoided and / or further investigated.

13.15.3 Surveys conducted prior to any works occurring will be carried out in compliance with the UAU guidelines. The data from these surveys will be assessed and used to identify locations of known and potential marine archaeological receptors. The results will contribute to an increased understanding of the locations on the seabed of potential and confirmed receptors which will be avoided by established AEZs.

13.15.4 AEZs will be implemented around known and identified potential sites of archaeological interest. All activities interfering with the seabed during the operation phase will be micro sited to avoid these AEZs.

13.15.5 A clear understanding of the responsibilities and commitments of all parties involved in any construction works will be ensured through the strategies laid out in the project's AMP and work-specific methods statements.

13.15.6 Unexpected, unconfirmed, and unknown receptors will be reported via the PAD system when an archaeologist is not present onboard and will be recommended AEZs or further archaeological work as per the project's AMP.

13.15.7 An archaeological assessment will occur and the DCHG will be consulted should any project activities that may be necessary within established AEZs prior to any work commencing, and a method statement detailing any planned developmental and archaeological works will be produced.

13.15.8 Watching briefs will be undertaken where relevant if impact to marine archaeological receptors is anticipated during intrusive activities or if material will be moved or removed from the seabed.

13.15.9 Anomalies of archaeological potential and / or interest will be investigated where possible during the life of the project to contribute to the understanding of the marine archaeological environment.

## Impact 6: Scour effects caused by the presence of WTG and substation foundations, causing, or accelerating loss of the receptor.

13.15.10 Scour effects, the removal of sediment around a foundation due to tidal movement, caused by the presence of WTG and OSP foundations, can lead to direct and / or indirect impacts on marine archaeological receptors by impacting and exposing such material to natural, chemical, or biological processes. Increase in scour may cause changes to the sediment type or grain size, and an increase in turbulence and current flow speed in localised areas.

13.15.11 If any marine archaeological receptors are subject to increased sedimentation which covers and protects the receptor as a result of the operational phase, the marine archaeological receptors might benefit from the conditions which could provide a higher level of preservation *in situ*, as exposure can lead to increased deterioration.

13.15.12 This assessment should therefore be read in conjunction with the Physical Process Chapter and the Physical Processes Technical Baseline which provide a full description of the offshore physical environment assessment (including project specific modelling of sediment plume dynamics).

13.15.13 The magnitude of Impact 6 is based on the definition shown in Table 6 . The assessment in Table 26 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12

13.15.14 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 27.

Table 26 Determination of magnitude for scour effects caused by the presence of WTG and substation foundations, causing, or accelerating loss of the receptor

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of scour effects caused by the presence of foundations on marine archaeological receptors may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the |
| Duration | The impact of scour effects caused by the presence of foundations on marine archaeological receptors is anticipated to be permanent. | In line with maximum design option. |
| Frequency | The impact of scour effects caused by the presence of foundations on marine archaeological receptors may occur once or repeatedly. | In line with maximum design option, however the impact will occur less frequently. |
| Probability | The impact of scour effects caused by the presence of foundations on | In line with the maximum design option. |

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| | marine archaeological receptors is likely to occur. | |
| Consequence | The impact of scour effects caused by the presence of foundations on marine archaeological receptors may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of scour will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 27 Determination of sensitivity of marine archaeological receptors to scour effects caused by the presence of WTG and OSP foundations, causing, or accelerating loss of the receptor

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of scour caused by the presence of foundations and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate the proposed form of change.<br>**Recoverability:**<br>The effect on marine archaeological receptors is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to having no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.15.15 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.15.16 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.15.17 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

### Residual effect assessment

13.15.18 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.15.19 The significance of effect is therefore **Not Significant**, in EIA terms.

13.15.20 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of scour effects caused by the presence of WTG and OSP foundations.

## Impact 7: Remedial burial of inter-array and export cables that become exposed and replacement of damaged cables.

13.15.21 Disturbance of sediment during cable maintenance activities may lead to the direct and / or indirect impacts on marine archaeological receptors resulting in the total or partial loss of the same.

13.15.22 The magnitude of Impact 7 is based on the definition shown in Table 6. The assessment in Table 28 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12

13.15.23 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 29.

Table 28 Determination of magnitude of effects from remedial burial of inter-array and export cables that become exposed and replacement of damaged cables

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of exposure of archaeological receptors from cable related activities may range from across and beyond the whole receptor to having no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the area impacted will be less. |
| Duration | The impact on marine archaeological receptors exposed | In line with the maximum design option. |

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| | during cable related activities is anticipated to be permanent. | |
| Frequency | The impact on marine archaeological receptors exposed during cable related activities may occur once or repeatedly. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact is likely to occur. | In line with the maximum design option. |
| Consequence | May range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the area impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 29 Determination of sensitivity for marine archaeological receptors to remedial burial of inter-array and export cables and replacement of damaged cables

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact of exposure due to cable related activities and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate the impact of exposed due to cable related activities.<br>**Recoverability:**<br>The effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.15.24 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.15.25 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.15.26 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

### Residual effect assessment

13.15.27 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.15.28 The significance of effect is therefore **Not Significant**, in EIA terms.

13.15.29 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of remedial burial of inter-array and export cables and replacement of damaged cables.

## Impact 8: Penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors).

13.15.30 Penetration and compression effects of jack-up barges and anchoring of operation and maintenance vessels can lead to direct and / or indirect impacts on marine archaeological receptors.

13.15.31 Impacts from penetration and compression can result in total or partial loss of marine archaeological receptors contained in the sediments below jack-up vessels or anchors.

13.15.32 The magnitude of Impact 8 is based on the definition shown in Table 6. The assessment in Table 30 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12.

13.15.33 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 31.

Table 30 Determination of magnitude of penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors) on marine archaeological receptors

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of penetration and compression due to operation and maintenance activities may range from across and beyond the whole receptor to having no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment impacted will be less. |
| Duration | The impact on marine archaeological receptors due to penetration and compression from operation and maintenance activities is anticipated to be permanent. | In line with the maximum design option. |
| Frequency | The impact on marine archaeological receptors due to penetration and compression from operation and maintenance activities may occur once or repeatedly. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact on marine archaeological receptors due to penetration and compression from operation and maintenance activities is likely to occur. | In line with maximum design option. |
| Consequence | The impact on marine archaeological receptors due to penetration and compression from operation and maintenance activities may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of sediment impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 31 Determination of sensitivity of marine archaeological receptors to penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors)

| Marine archaeological receptor | Justification |
|---|---|
| Context | **Adaptability:**<br>Marine archaeological receptors are unable to adapt to the impact from penetration and compression due to operation and maintenance activities and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>**Tolerance:**<br>Marine archaeological receptors have no or a very low capacity to accommodate the impact from penetration and compression<br>**Recoverability:**<br>The effect on marine archaeological receptors is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. Marine archaeological receptors may range from unique to having no recognised value with regards to factors including period, rarity, level of documentation, group value, condition, vulnerability, diversity, and /or archaeological significance are present within the marine archaeological study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Value | Marine archaeological receptors may range from unique to having no recognised value with regards to factors including period, rarity, level of documentation, group value, condition, vulnerability, diversity, and /or archaeological significance are present within the marine archaeological study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.15.34 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.15.35 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.15.36 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

## Residual effect assessment

13.15.37 Following the utilisation of all avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.15.38 The significance of effect is therefore **Not Significant**, in EIA terms.

13.15.39 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors).

## 13.16 Environmental assessment: decommissioning phase

13.16.1 As referenced in the Project Description, the Decommissioning and Restoration Plan (Volume 7, Appendix 2), including the three rehabilitation schedules attached thereto, describes how the Applicant proposes to rehabilitate that part of the maritime area, and any other part of the maritime area, adversely affected by the permitted maritime usages that are the subject of the MACs (Reference Nos. 2022-MAC-003 and 004 / 20230012 and 240020).

13.16.2 It is based on the best scientific and technical knowledge available at the time of submission of this planning application. However, the lengthy passage of time between submission of the application and the carrying out of decommissioning works (expected to be in approximately 35 years as defined in the MDO) gives rise to knowledge limitations and technical difficulties. Accordingly, the Decommissioning and Restoration Plan will be kept under review by the Applicant as the project progresses, and an alteration application will be submitted if necessary. In particular, it will be reviewed having regard to the following:

- The baseline environment at the time rehabilitation works are proposed to be carried out,
- What, if any, adverse effects have occurred that require rehabilitation,
- Technological developments relating to the rehabilitation of marine environments,
- Changes in what is accepted as best practice relating to the rehabilitation of marine environments,
- Submissions or recommendations made to the Applicant by interested parties, organisations and other bodies concerned with the rehabilitation of marine environments, and/or
- Any new relevant regulatory requirements.

13.16.3 The Decommissioning and Restoration Plan outlines the process for decommissioning of the WTG, foundations, scour protection, OSP, inter array cables and Offshore ECC. The plan outlines the assumption that the most practicable environmental option is to leave certain structures in situ (e.g. inter array cables, scour protection), however the general principle for decommissioning is for all structures to be removed and it is assumed that the wind turbine generators (WTGs) will be dismantled and completely removed to shore, with piled foundations cut at a level just below the seabed.

### Application of avoidance and preventative measures

13.16.4 The avoidance and preventative measures as outlined in Table 15 will ensure: that all surveys will be licensed under the National Monuments Acts 1930-2014; that unknown marine archaeological receptors are located and identified; and known marine archaeological receptors are avoided and / or further investigated.

13.16.5 A clear understanding of the responsibilities and commitments of all parties involved in any decommissioning works will be ensured through the strategies laid out in the project's AMP, work-specific methods statements and the Decommissioning and Restoration Plan.

13.16.6 Unexpected, unconfirmed, and unknown receptors will be reported via the PAD system when an archaeologist is not present onboard and will be recommended AEZs or further archaeological work as per the project's AMP.

13.16.7 An archaeological assessment will occur and the DHLGH will be consulted should any project activities that may be necessary within established AEZs prior to any work commencing, and a method statement detailing any planned developmental and archaeological works will be produced.

13.16.8 Watching briefs will be undertaken where relevant if impact to marine archaeological receptors is anticipated during intrusive activities or if material will be moved or removed from the seabed.

13.16.9 Anomalies of archaeological potential and / or interest will be investigated during the life of the project, where possible, to contribute to the understanding of the marine archaeological environment.

## Impact 9: Draw-down of sediment into voids left by removed WTG foundations leading to loss of sediment, causing, or accelerating loss of the receptor.

13.16.10 Draw-down of sediment into voids left by removed WTG and OSP structures can lead to indirect or direct impact on marine archaeological receptors causing or accelerating loss of the receptor.

13.16.11 The details of the proposed decommissioning process will be included within the Decommissioning and Restoration Plan (Table 15) which will be developed and updated throughout the lifetime of Dublin Array Offshore Wind Farm to account for changing best practice and legislative provisions.

13.16.12 The magnitude of Impact 9 is based on the definition shown in Table 6. The assessment in Table 32 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12.

13.16.13 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 33.

Table 32 Determination of magnitude of draw-down of sediment into voids left by removed WTG foundations leading to loss of sediment, causing, or accelerating loss of marine archaeological receptors

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of draw-down of sediment following the removal of infrastructure may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment impacted will be less. |
| Duration | The impact on marine archaeological receptors by draw-down of sediment following the removal of infrastructure is anticipated to be permanent. | In line with maximum design option. |
| Frequency | The impact on marine archaeological receptors by draw-down of sediment following the removal of infrastructure will occur based on number of infrastructures removed. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact on marine archaeological receptors by draw-down of sediment following the removal of infrastructure is likely to occur. | In line with the maximum design option. |
| Consequence | The impact on marine archaeological receptors by draw-down of sediment following the removal of infrastructure may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of sediment impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 33 Determination of sensitivity of marine archaeological receptors to draw-down of sediment into voids left by removed WTG foundations leading to loss of sediment, causing or accelerating loss of marine archaeological receptors

| Marine archaeological receptor | Justification |
|---|---|
| Context | Adaptability: |

| Marine archaeological receptor | Justification |
|---|---|
| | Marine archaeological receptors are unable to adapt to the impact from draw-down of sediment following the removal of infrastructure and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and / or damage to physical archaeological receptors.<br>Tolerance:<br>Marine archaeological receptors have no or a very low capacity to accommodate the impact from draw-down effects.<br>Recoverability:<br>The effect on the receptor is anticipated to be permanent (i.e., over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to having no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed to be high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.16.14 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.16.15 The magnitude of impact with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as being **High**.

13.16.16 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

## Residual effect assessment

13.16.17 Following the utilisation of all avoidance and preventative measures it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.16.18 The significance of effect is therefore **Not Significant**, in EIA terms.

13.16.19 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of draw-down of sediment into voids left by removed WTG and OSP foundations.

## Impact 10: Penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels.

13.16.20 Penetration and compression effects of jack-up barges and anchoring of decommissioning vessels can lead to direct and / or indirect impacts on marine archaeological receptors.

13.16.21 Impacts from penetration and compression can result in total or partial loss of marine archaeological receptors contained in the sediments below jack-up vessels and anchors.

13.16.22 The assessment have assumed the same quantitative requirements for seabed preparation, as it forms a proxy for disturbance. However, as seabed preparation works would not be required, the magnitude of this impact will be lower than during the construction phase.

13.16.23 The magnitude of Impact 10 is based on the definition shown in Table 6. The assessment in Table 34 is based on the potential of impacts on marine archaeological receptors both as a baseline and with the assumption of the implementation of the avoidance and preventative measures. The assessment is based on methodology outlined in Section 13.12.

13.16.24 The sensitivity of the marine archaeological receptor is based on the definition shown in Table 7 and assessed in Table 35.

Table 34 Determination of magnitude of penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels on marine archaeological receptors

| | Assessment of maximum design option | Assessment of alternative design option |
|---|---|---|
| Extent | The impact of penetration and compression due to decommissioning vessels may range from across and beyond the whole receptor to no impact on the receptor. | In line with the maximum design option, impacts may range from across and beyond the whole receptor to having no impact on the receptor, however the volume of sediment impacted will be less. |
| Duration | The impact on marine archaeological receptors by penetration and compression due to decommissioning vessels is anticipated to be permanent. | In line with the maximum design option. |
| Frequency | The impact on marine archaeological receptors by penetration and compression due to decommissioning vessels may occur once or repeatedly. | In line with the maximum design option, however the impact will occur less frequently. |
| Probability | The impact on marine archaeological receptors by penetration and compression due to decommissioning vessels is likely to occur. | In line with the maximum design option. |
| Consequence | The impact on marine archaeological receptors by penetration and compression may range from substantial or irreversible change to beneficial or consequences indistinguishable from natural change. | In line with the maximum design option, impacts may range in their degree of change to the receptor, however the volume of sediment impacted will be less. |
| Overall magnitude as a baseline | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High.*** | *The potential magnitude of impact on marine archaeological receptors as a baseline is rated as **High**.* |
| Overall magnitude following mitigation | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible.*** | *The potential magnitude of impact on marine archaeological receptors following mitigation is rated as **Imperceptible**.* |

Table 35 Determination of sensitivity of marine archaeological receptors to penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels.

| Marine archaeological receptor | Justification |
|---|---|
| Context | Adaptability:<br>Marine archaeological receptors are unable to adapt to the impact of penetration and compression due to decommissioning vessels and will be substantially or irreversibly changed. Impacts may include permanent loss of archaeological contexts and /or damage to physical archaeological receptors.<br>Tolerance:<br>Marine archaeological receptors have no or a very low capacity to accommodate the impact from penetration and compression.<br>Recoverability:<br>The effect on marine archaeological receptors is anticipated to be permanent (i.e. over 60 years) and recovery is not anticipated as marine archaeological receptors are an inanimate and finite resource. |
| Value | Marine archaeological receptors may range from unique to having no recognised value with regards to period, rarity, level of documentation, group value, condition, vulnerability, diversity, and / or archaeological significance are present within the marine archaeology study area. Therefore, value will be assumed as high until sufficient assessment to determine these factors can be made. |
| Overall sensitivity | *The potential sensitivity of marine archaeological receptors is rated as **High**.* |

13.16.25 The baseline magnitude of the impact has been assessed as **High**, with the maximum sensitivity of the receptors being **High**.

13.16.26 The magnitude of impact from decommissioning activities (shown in Table 14) with assumption of implementation of the avoidance and preventative measures has been assessed as **Negligible**, with the maximum sensitivity of the receptors as **High**.

13.16.27 The alternative design options (any other option within the range of parameters set out in the project description) will not give rise to an effect which is more significant than the maximum design option.

## Residual effect assessment

13.16.28 Following the utilisation of all mitigation recommendations, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible.**

13.16.29 The significance of effect is therefore **Not Significant**, in EIA terms.

13.16.30 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels.

# 13.17 Environmental assessment: cumulative effects

## Methodology

13.17.1 This section outlines the cumulative effects assessment on marine archaeology and takes into account the impacts of the proposed development assessed together with other plans and projects. As outlined in the Cumulative Impact Assessment Methodology chapter (Volume 2, Chapter 4), the screening process involved determination of appropriate search areas for projects, plans and activities and Zones of Influence (ZoIs) for potential cumulative effects. These were then screened according to the level of detail publicly available and the potential for interactions with regard to the presence of an impact pathway as well as spatial and temporal overlap.

13.17.2 The CEA long list of projects, plans and activities with which Dublin Array's offshore infrastructure has the potential to interact with to produce a cumulative effect is presented within Volume 2, Chapter 4, Annex A: Offshore long-list (hereafter referred to as the Offshore Long-list. Each plan and project has been considered on a case by case basis with the maximum suite of projects identified from a long list within a search area defined as the ICES Ecoregion subsection 7a. Division 7a of the Celtic Sea ICES Ecoregion[8] is considered appropriate for this exercise in relation to marine archaeology as it will fully encompass all projects and plans with the potential to have spatial overlap with the effects of the offshore works associated with Dublin Array.

13.17.3 For the purposes of this assessment the zone of influence for marine archaeological receptors has been considered within a 17 km buffer from the Dublin Array Offshore Wind Farm development boundary. This has been defined by the maximum areas that a sediment plume will travel from Dublin Array (equal to a single tidal ellipse in addition to a 1 km buffer). On the basis that these tidal ellipses will be regionally similar, and therefore sediment plumes from nearby projects and plans may travel a similar distance. Due to the nature of tidal streams, any suspended sediment plumes will travel in the direction of the tidal transport, therefore, adjacent plumes will remain equidistant from one another as they are transported laterally.

13.17.4 The full list of plans and projects considered, including those screened out, are presented in the Long-list. For the purposes of the cumulative impact assessment, a precautionary construction period has been assumed between the years 2029 to 2032, with offshore construction (excluding preparation works) lasting up 30 months as a continuous phase within this period (refer to the Project Description Chapter). After construction, Dublin Array will be operational for 35 years.

[8] Ecoregions are used to provide regional advice, steer regional integrated approaches and are the primary geographical units for ICES to develop science, new techniques and monitoring programmes. They provide the broad-scale spatial framework for the knowledge base to address management challenges and monitor the changing ecology of the North-East Atlantic. Division 7a is part of the Celtic Sea Ecoregion and broadly covers the Irish Sea

## Projects scoped out

13.17.5 Projects not included in the longlist revised for Offshore Archaeology and Cultural Heritage include those:

- Outside of 17 km of the Dublin Array Offshore Wind Farm development boundary;
- Projects that are currently operational with no continued impact that may occur in combination with Dublin Array Offshore Wind Farm;
- Projects where there is low data confidence and so an accurate assessment cannot be made;
- Where there is no temporal overlap; and
- Projects that are currently operational and therefore included in the baseline, which are not assessed as having an ongoing impact.

## Projects for cumulative assessment

13.17.6 The specific projects scoped into this cumulative effect assessment on marine archaeological receptors and the tiers into which they have been allocated are presented in Table 36 below. The full list of plans and projects considered, including those screened out, are presented in the Offshore Long-list. The offshore construction programme will last up to 30 months. After construction, Dublin Array will be operational for approximately 35 years.

13.17.7 The rationale and MDO for the projects selected which have a potential to give rise to cumulative effects for sediment deposition is presented in the Physical Processes Chapter.

Table 36 Projects for cumulative assessment

| Development type | Project name | Current status of development | Data confidence assessment / phase | Planned programme |
|---|---|---|---|---|
| Tier 1 | | | | |
| Dumping at sea | Dublin Port Company Licence: S0004-03 | Operational | High – Operational | 2024 - 2029 |
| | Dublin Port Company Licence: S0004-02 | Operational | High – Operational | 2024 – 2029 |
| Subsea cables | EXA ATLANTIC | Active | High – Operational | 2024 –2035 |
| | ESAT 2 | Active | High – Operational | 2024 – 2035 |
| | CeltixConnect 1 (CC-1) | Active | High – Operational | 2024 – 2035 |
| | HIBERNIA 'C' | Active | High – Operational | 2021 – 2032 |
| | Emerald Bridge Fibres | Active | High – Operational | 2024 – 2035 |
| Survey | Bord Gais Networks FS006104 | Active | High – Operational | 2021 – 2119 |
| Future plans and programmes | Dublin Port Masterplan -ABR Project | Active | High - Operational | 2016 - present |
| Tier 2 | | | | |
| No screened projects classed as Tier 2. | | | | |
| Tier 3 | | | | |
| Coastal assets | Dublin Port Company MP2 Project | Application submitted | Medium – Under determination Reference: FS006893 | 2024 – 2032 |
| | Dublin Port Company- 3FM Project | Pre-consent | Medium – EIA available (submitted July 2024) | 2026 – 2040 |
| Offshore energy | Colwyn Bay Tidal Lagoon | Planning | Low – In planning | Not known |
| | Nephtyd | Suspended | Low - suspended | Not known |
| Subsea cables | Mares Connect | Proposed | Low – Proposed | 2024 – 2035 |
| Future plans | Minister for Housing, Planning and Local Government | Uploaded 2022 | Low | Not known |

| Development type | Project name | Current status of development | Data confidence assessment / phase | Planned programme |
|---|---|---|---|---|
| Offshore wind farm | Codling Wind Park | Phase 1 (MAC awarded) Pre-consent | Medium | 2027 - 2035 |

## Effect 11: Cumulative disturbance of sediment containing potential marine archaeological receptors during all phases of Dublin Array Offshore Wind Farm.

13.17.8 The potential for cumulative effects as a result of disturbance of sediment containing potential marine archaeological receptors (material and contexts) is presented in Table 37.

Table 37 Determination of magnitude for disturbance of sediment containing potential marine archaeological receptors (material and contexts)

| | Justification |
|---|---|
| Step 1: Drivers | Changes in the tidal and wave regimes through the presence of structures or movement of large volumes of sediments in the marine environment could potentially change sediment processes. |
| Step 2: Pressures | Interaction between separate wind farm structures and the movement of sediment as a result of dredging and dumping at sea and the presence of OWF's could increase or decrease sediment erosion or accumulation across the marine archaeology study area, which is different from natural variation. Based on findings in the Physical Processes Chapter, dredging and dumping at sea temporarily increases the Suspended Sediment Concentrations and associated sediment deposition. For other OWF's, the upwind path for southerly waves propagating through Codling Wind Park could theoretically extend to Dublin Array and have a similar level of reduction in wave energy for the "typical" wave from the south and southeast. |
| Step 3: States | All known and unknown marine archaeological receptors may be affected. |
| Step 4: Impacts | The effects on marine archaeological receptors from the Dublin Array Offshore Wind Farm infrastructure alone with mitigation applied were deemed to be not significant in EIA terms (see Impacts 1-10).<br>Cumulative effects may arise resulting in the interaction of sediment plumes and additive deposition footprints (as discussed in the Physical Processes Chapter), however these are anticipated to be within natural variation range.<br>Considering similar programmes for the mitigation of direct and indirect impact on marine archaeological receptors across all scoped in projects, it is anticipated that similar magnitudes of effects would occur for these projects alone as detailed in their individual EIAs (not significant in EIA terms) (for example: Environmental Impact Assessment Report (EIAR) – Codling Wind Park Planning Application).<br>It is therefore not anticipated that the cumulative changes arising |

| | Justification |
|---|---|
| | from the activities and presence of the developments will be significant in EIA terms when considered cumulatively. |
| Step 5: Responses | No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects. |
| Conclusion | *It is not anticipated that the cumulative changes arising from the activities and presence of the developments would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.* |

## Dumping at sea sites

13.17.9 There are two operational dumping at sea sites within 17 km of the proposed Dublin Array Offshore Wind Farm development area.

13.17.10 Changes in the movement of sediments in the marine environment due to the activities associated with dumping at sea could potentially change sediment processes.

13.17.11 Interaction between Dublin Array Offshore Wind Farm infrastructure and the movement of sediment as a result of dumping at sea could increase or decrease sediment erosion or accumulation across the marine archaeology study area, thereby altering or destabilising marine archaeological sites or contexts, including palaeoenvironmental material, and exposing such material to natural, chemical, or biological processes, causing or accelerating the loss of the receptor.

13.17.12 The cumulative effects of dumping at sea and Dublin Array Offshore Wind Farm have the potential to affect all known and unknown marine archaeological receptors.

13.17.13 The impacts from cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm, and the presence of active dumping at sea sites in the locality, as set out in Table 36 may result in the loss or accumulation of sediment, however, despite the intrusive nature of disposal activities on the sea floor, no direct cumulative effects on marine archaeological receptors within the Dublin Array Offshore Wind Farm development area are expected as there is no expected spatial overlap of sediment change likely as a result of dumping at sea activities in combination with Dublin Array Offshore Windfarm.

13.17.14 The cumulative effects during all Dublin Array Offshore Wind Farm project phases and the described disposal sites are therefore predicted to cause potential spatial (and temporal) overlap of SSC plumes generated by the developments. Assuming the application of the avoidance and preventative measures (Table 15) it is not anticipated that the cumulative changes arising from the activities and presence of the developments will be significant in EIA terms when considered cumulatively. Capital dredging and disposal will cause temporary localised sediment plumes both at the loading and licensed disposal sites.

13.17.15 No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects.

13.17.16 It is not anticipated that the cumulative changes arising from the activities and presence of sea disposal activities would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.

## Offshore wind developments

13.17.17 There is one Phase 1 offshore wind development, Codling Wind Park, within 17 km of the proposed Dublin Array Offshore Wind Farm development area which is pre-consent at the time of writing.

13.17.18 It is expected that all offshore wind project construction phases, as well as operation and maintenance phases, have the potential to cause seabed disturbance as cables and foundation structures require regular planned and unplanned maintenance.

13.17.19 All East coast Phase 1 Offshore wind projects in Ireland have been awarded a Maritime Area Consent (MAC) and have submitted planning applications, consideration has been given here to the EIA and supporting technical studies as relevant.

13.17.20 Relevant Phase 1 projects include:

- Codling Wind Park

13.17.21 Changes in the tidal and wave regimes through the presence of structures or movement of sediments in the marine environment due to the activities associated with Codling Wind Park could potentially change sediment processes. The disturbance could alter or destabilise archaeological sites and contexts, including palaeoenvironmental material, and expose such material to natural, chemical, or biological processes, causing or accelerating loss of marine archaeological receptors.

13.17.22 Cumulative effects may also occur indirectly through the cumulative lack of access to the historic environment and palaeoenvironmental evidence. The total coverage of the Dublin Array Offshore Wind Farm infrastructure (foundations and cables) detailed in the Project Description Chapter will impede direct access below the infrastructure for up to 35 years. The lack of access will be offset by the gathering of information (including geophysical and geotechnical surveys) along the planned export cable route and within the array areas, with the details of these investigations contained in forthcoming specific Method Statements produced and agreed ahead of investigations, as set out in the AMP. The combination of assessments across the offshore wind developments will be used to build on a deposit model that illustrates the now submerged palaeoenvironment across the development area and surrounding context.

13.17.23 Codling Wind Park Array will cover an area of 125 $km^2$ with a 50km ECC. A section of the Codling Wind Park ECC will overlap with the Dublin Array ECC. . As stated above, each wind farm has or will undertake a marine archaeology impact assessment that outlines and confirms maximum design parameters, potential impact on marine archaeological receptors and specific mitigation strategies.

13.17.24 Interaction between Dublin Array Offshore Wind Farm infrastructure and the movement of sediment as a result of Codling Wind Park could increase or decrease sediment erosion or accumulation across the marine archaeology study area, thereby altering or destabilising marine archaeological sites or contexts, including palaeoenvironmental material, and exposing such material to natural, chemical, or biological processes, causing or accelerating the loss of the receptor.

13.17.25 The direct cumulative effects of Codling Wind Park and Dublin Array Offshore Wind Farm have the potential to affect all known and unknown marine archaeological receptors.

13.17.26 The indirect impacts from cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm, and the presence of active Codling Wind Park in the locality, as set out in Table 36 may result in the loss or accumulation of sediment, however, despite the intrusive nature of installation and maintenance activities on the sea floor, no direct cumulative effects on marine archaeological receptors within the Dublin Array Offshore Wind Farm development area are expected as Codling Wind Park archaeological mitigation measures will avoid impact on known and unknown sites.

13.17.27 The cumulative effects during all Dublin Array Offshore Wind Farm project phases and Codling Wind Park are therefore predicted to be of local spatial extent and long term duration. Assuming the application of the avoidance and preventative measures (Table 15) it is therefore not anticipated that the cumulative changes arising from the activities and presence of the developments will be significant in EIA terms when considered cumulatively.

13.17.28 No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects.

13.17.29 It is not anticipated that the cumulative changes arising from the activities and presence of Codling Wind Park would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.

## Subsea cables and coastal assets

13.17.30 Within 17 km of the proposed development area for Dublin Array Offshore Wind Farm there are five operational subsea cables, one proposed subsea cable; and two proposed coastal assets (Dublin Port Company MP2 and 3FM).

13.17.31 Changes in the movement of sediments in the marine environment due to the presence of infrastructure or activities associated with subsea cables and coastal assets could potentially change sediment processes. Direct and / or indirect impacts from penetration, compression and disturbance or cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm and the presence of subsea cables and pipelines as outlined in Table 36 may result in the loss or accumulation of sediment over time. It is expected that all subsea cable preparation, construction phases and operation and maintenance phases, have the potential to cause seabed disturbance as cables require regular planned and unplanned maintenance.

13.17.32 Interaction between Dublin Array Offshore Wind Farm infrastructure and the movement of sediment as a result of subsea cables and coastal assets could increase or decrease sediment erosion or accumulation across the marine archaeology study area, thereby altering or destabilising marine archaeological sites or contexts, including palaeoenvironmental material, and exposing such material to natural, chemical, or biological processes, causing or accelerating the loss of the receptor.

13.17.33 The cumulative effects of subsea cables and coastal assets and Dublin Array Offshore Wind Farm have the potential to affect all known and unknown marine archaeological receptors.

13.17.34 Maintenance operations of subsea cables and coastal assets, if undertaken, may alter or destabilise unknown marine archaeological receptors, archaeological sites, and contexts, including palaeoenvironmental information, and exposing such material to natural, chemical, or biological processes causing or accelerating loss of these receptors.

13.17.35 The impacts from cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm, and the presence of active subsea cables and coastal assets in the locality, as set out in Table 36 may result in the loss or accumulation of sediment, however, despite the intrusive nature of installation and maintenance activities on the sea floor, no direct cumulative effects on marine archaeological receptors within the Dublin Array Offshore Wind Farm development area are expected as there is no spatial overlap or indirect effects from interaction of sediment plumes.

13.17.36 Potential cumulative effects during all project phases of Dublin Array Offshore Wind Farm and the described presence of subsea cables and coastal infrastructure (Table 36) are therefore predicted to be of local spatial extent and long term duration.

13.17.37 The cumulative effects during all Dublin Array Offshore Wind Farm project phases and the described subsea cables and coastal assets are therefore predicted to be of local spatial extent and long term duration. Assuming the application of the avoidance and preventative measures (Table 15) it is therefore not anticipated that the cumulative changes arising from the activities and presence of the developments will be significant in EIA terms when considered cumulatively.

13.17.38 No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects.

13.17.39 It is not anticipated that the cumulative changes arising from the activities and presence of subsea cables and coastal assets would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.

## Other offshore energy

13.17.40 Within 17 km of the proposed development area for Dublin Array Offshore Wind Farm there are two additional offshore energy projects in the planning stages.

13.17.41 Changes in the movement of sediments in the marine environment due to the presence of structures or movement of sediments in the marine environment activities associated with offshore energy could potentially change sediment processes.

13.17.42 Interaction between Dublin Array Offshore Wind Farm infrastructure and the movement of sediment as a result of offshore energy projects could increase or decrease sediment erosion or accumulation across the marine archaeology study area, thereby altering or destabilising marine archaeological sites or contexts, including palaeoenvironmental material, and exposing such material to natural, chemical, or biological processes, causing or accelerating the loss of the receptor.

13.17.43 The cumulative effects of offshore energy and Dublin Array Offshore Wind Farm have the potential to affect all known and unknown marine archaeological receptors.

13.17.44 The impacts from cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm, and the presence of active offshore energy projects in the locality, as set out in Table 36 may result in the loss or accumulation of sediment, however, despite the intrusive nature of installation and maintenance activities on the sea floor, no direct cumulative effects on marine archaeological receptors within the Dublin Array Offshore Wind Farm development area are expected as there is no spatial overlap or indirect effects from interaction of sediment plumes.

13.17.45 The cumulative effects during all Dublin Array Offshore Wind Farm project phases and the described offshore energy projects are therefore predicted to be of local spatial extent and long term duration. Assuming the application of the avoidance and preventative measures (Table 15) it is therefore not anticipated that the cumulative changes arising from the activities and presence of the developments will be significant in EIA terms when considered cumulatively.

13.17.46 No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects.

13.17.47 It is not anticipated that the cumulative changes arising from the activities and presence of offshore energy projects would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.

## Surveys

13.17.48 Within 17 km of the proposed development area for Dublin Array Offshore Wind Farm there is one active foreshore licence, one approved pre-installation survey licence and one foreshore licence under application for site surveys.

13.17.49 Changes in the movement of sediments in the marine environment due to the activities associated with survey activities could potentially change sediment processes.

13.17.50 Interaction between Dublin Array Offshore Wind Farm infrastructure and the movement of sediment as a result of survey activities could increase or decrease sediment erosion or accumulation across the marine archaeology study area, thereby altering or destabilising marine archaeological sites or contexts, including palaeoenvironmental material, and exposing such material to natural, chemical, or biological processes, causing or accelerating the loss of the receptor.

13.17.51 The cumulative effects of survey activities and Dublin Array Offshore Wind Farm have the potential to affect all known and unknown marine archaeological receptors.

13.17.52 The impacts from cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm, and survey activities in the locality, as set out in Table 36 may result in the loss or accumulation of sediment, however, despite the intrusive nature of disposal activities on the sea floor, no direct cumulative effects on marine archaeological receptors within the Dublin Array Offshore Wind Farm development area are expected as there is no spatial overlap or indirect effects from interaction of sediment plumes.

13.17.53 The cumulative effects during all Dublin Array Offshore Wind Farm project phases and the described survey licences are therefore predicted to be of local spatial extent and long term duration. Assuming the application of the avoidance and preventative measures (Table 15) it is therefore not anticipated that the cumulative changes arising from the activities and presence of the developments will be significant in EIA terms when considered cumulatively.

13.17.54 No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects.

13.17.55 It is not anticipated that the cumulative changes arising from the activities and presence of sea disposal activities would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.

## Future plans and programmes

13.17.56 Within 17 km of the proposed development area for Dublin Array Offshore Wind Farm there is one operational programme for the Alexander Basin redevelopment and one programme in planning for a similar port redevelopment.

13.17.57 Changes in the movement of sediments in the marine environment due to the activities associated with future plan and programme activities could potentially change sediment processes.

13.17.58 Interaction between Dublin Array Offshore Wind Farm infrastructure and the movement of sediment as a result of future plan and programme activities could increase or decrease sediment erosion or accumulation across the marine archaeology study area, thereby altering or destabilising marine archaeological sites or contexts, including palaeoenvironmental material, and exposing such material to natural, chemical, or biological processes, causing or accelerating the loss of the receptor.

13.17.59 The cumulative effects of future plan and programme activities and Dublin Array Offshore Wind Farm have the potential to affect all known and unknown marine archaeological receptors.

13.17.60 The impacts from cumulative sediment changes during all project phases of Dublin Array Offshore Wind Farm, and future plan and programme activities in the locality, as set out in Table 36 may result in the loss or accumulation of sediment, however, despite the potentially intrusive nature of activities on the sea floor, no direct cumulative effects on marine archaeological receptors within the Dublin Array Offshore Wind Farm development area are expected as there is no spatial overlap or indirect effects from interaction of sediment plumes.

13.17.61 The cumulative effects during all Dublin Array Offshore Wind Farm project phases and the described future plans and programmes are therefore predicted to be of local spatial extent and long term duration. Assuming the application of the avoidance and preventative measures (Table 15) it is therefore not anticipated that the cumulative changes arising from the activities and presence of the developments will be significant in EIA terms when considered cumulatively.

13.17.62 No additional mitigation to that already identified in Table 15 is considered necessary to prevent significant effects.

13.17.63 It is not anticipated that the cumulative changes arising from the activities and presence of sea disposal activities would be measurable as different from natural variation or be significant in EIA terms when considered cumulatively.

### Cumulative assessment summary

13.17.64 The avoidance and preventative measures, as outlined in Table 15 aim to avoid and mitigate direct, indirect and permanent impact on known and unknown marine archaeological receptors within the proposed development area for Dublin Array Offshore Wind Farm and ensure that archaeological input is of paramount importance throughout the life of the Project.

13.17.65 Considering the magnitude of the cumulative effects during all phases of Dublin Array Offshore Wind Farm and the outlined other developments (Table 36) as well as receptor sensitivity within the significance of effect following the utilisation of all avoidance and preventative measures, it is assessed that no additional impact arising from cumulative effects should occur meaning that the sensitivity of the marine archaeological receptor will be **Low**, and the magnitude of the impact is **Imperceptible**. No additional mitigation measures are recommended.

13.17.66 The significance of effect is therefore not significant, in EIA terms.

13.17.67 The significance of effect from changes to marine archaeological receptors is not significant in EIA terms. Therefore, no additional mitigation to that already identified in Table 15 is considered necessary. Therefore, **no significant adverse residual effects** have been predicted in respect of cumulative effects.

## 13.18 Interactions of the environmental factors

13.18.1 A matrix illustrating where interactions between effects on different factors have been addressed is provided in Volume 8, Chapter 1: Interactions of the Environmental Factors (hereafter referred to as the Interactions Chapter.

13.18.2 Interactions of the foregoing are considered to be the effects and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the project (construction, O&M and decommissioning) to interact and potentially create a more significant effect on a receptor than if just assessed in isolation in these three project phases; and
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on benthic ecology such as direct habitat loss or disturbance, sediment plumes, scour, jack up vessel use etc., may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short-term, temporary or transient effects.

13.18.3 As indicated in the interactions matrix (refer to the Interactions Chapter) there are linkages between the topic-specific chapters presented within this EIAR, whereby the effects assessed in one chapter have either the potential to result in secondary effects on another receptor (e.g. effects on fish and shellfish ecology have the potential to result in secondary effects on marine mammals prey resources).

13.18.4 The potential effects on marine archaeology during construction, operational and maintenance and decommissioning phases of the Project have been assessed in sections 13.14 - 13.16 above.

13.18.5 For marine archaeology receptors, the following potential impacts have been considered within the interactions assessment:

- Removal of sediment containing undisturbed marine archaeological receptors during seabed preparation for WTG and OSP foundations and cables;
- Disturbance of sediment containing potential marine archaeological receptors during the laying of inter-array cables and export cable laying operations; and
- Penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, OSP, or cable installation on marine archaeological receptors.

13.18.6 Regarding interactions with physical processes, effects on the sediment regime (i.e. from increases in SSC and sediment deposition above background levels or changes to sediment transport pathways) associated with changes in physical processes also have the potential to have secondary effects on marine archaeology (i.e. Disturbance of sediment containing potential marine archaeology).

13.18.7 The potential effects of the construction, O&M and decommissioning of the offshore infrastructure of Dublin Array on physical processes and resulting indirect effects on marine archaeology receptors have been assessed in section 13.14 – 13.15 above.

## Project lifetime effects

13.18.1 Project lifetime effects consider impacts from the construction, operation or decommissioning of Dublin Array on the same receptor (or group). The potential inter-related effects that could arise in relation to marine archaeology are presented in Table 38.

Table 38 Project lifetime effects assessment for potential inter-related effects on marine archaeology.

| Impact Type | Effects (Assessment Alone) | | | Interaction Assessment |
|---|---|---|---|---|
| | C | O&M | D | Project lifetime effects |
| Disturbance of sediment containing potential marine archaeological receptors during the laying and replacement of inter-array cables and export cable laying operations. | Imperceptible | Imperceptible | N/A | Disturbance and effects on archaeological receptors relating to sediment disturbance have the potential to occur during the construction and operational phases of the offshore works, with the majority of potential disturbance and damage effects to archaeology arising during the construction phase. Regarding decommissioning, it is envisaged that buried cables will be cut and left in situ (to be determined in consultation with key stakeholders as part of the decommissioning plan and following best practice at the time of decommissioning). It is therefore considered that impacts in the decommissioning phase will not materially contribute to inter-related effects.<br>Following the utilisation of all mitigation recommendations, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be Low, and the magnitude of the impact is Imperceptible during all phases.<br>During the construction and operational phases, the implementation of the avoidance and preventative measures referenced in Table 15 and throughout sections 13.14 - 13.16 work to reduce the risk of significant effects on marine archaeology receptors to not significant in EIA terms. Furthermore, replacement of previously laid cables during the operational phase will only occur where required.<br>Therefore, across the project lifetime, the effects on archaeology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase. |
| Penetration and compression effects of jack-up vessels and anchoring of | Imperceptible | Imperceptible | Imperceptible | While jack-up vessels may be required throughout all phases of the development, the greatest extent of activities from jack-up vessels resulting in direct impact to the seabed will likely occur during the construction phase. However, surveys conducted prior to any works |

| Impact Type | Effects (Assessment Alone) | | | Interaction Assessment |
|---|---|---|---|---|
| | C | O&M | D | Project lifetime effects |
| vessels during various construction, O&M and decommissioning activities on marine archaeological receptors. | | | | occurring will be used to identify locations of known and potential marine archaeological receptors. The results will contribute to an increased understanding of the locations on the seabed of potential and confirmed receptors which will be avoided by established Archaeological Exclusion Zones. Secondly, unexpected, unconfirmed, and unknown receptors will be reported via the PAD system and will be recommended Archaeological Exclusion Zones or further archaeological work as per the project's Archaeological Management Plan. Finally, anomalies of archaeological potential and / or interest will be investigated during the life of the project, where possible, to contribute to the understanding of the marine archaeological environment. With the implementation of these avoidance and preventative measures, it is assessed that no impact should occur meaning that the sensitivity of the marine archaeological receptor will be Low, and the magnitude of the impact is Imperceptible during all phases.<br><br>Furthermore, the use of jack-up vessels will be temporary and intermittent across all phases, effects on archaeological receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase. |

### Receptor led effects

13.18.2 Potential exists for spatial and temporal interactions between impacts to archaeology receptors. The greatest scope for potential interactions between impacts is predicted to arise from the interaction of the disturbance of sediment containing potential marine archaeological receptors during the laying and replacement of inter-array cables and export cable laying operations and the penetration and compression effects of jack-up vessels and anchoring of vessels during various construction, O&M and decommissioning activities on marine archaeological receptors.

13.18.3 Where avoidance and preventative measures are implemented as set out in Table 15 and throughout sections 13.14 - 13.16, the significance of effects on marine archaeology receptors for both impacts is reduced to not significant in EIA terms for both impacts alone. As such, while the two effects may act together, it is considered that appropriately mitigated construction, O&M and decommissioning activities to avoid potential impacts to marine archaeology will result in any inter-related effect will not be of any greater significance than those already assessed in isolation.

13.18.4 Overall, the interactions of the foregoing assessment does not identify any significant inter-related effects that were not already covered by the topic-specific assessment set out in the preceding sections. However, certain individual effects were identified that did interact with each other whilst not leading to any greater significance of effect.

## 13.19 Transboundary statement

No transboundary effects have been identified. This is because the predicted changes to the key physical process pathways (i.e., tides, waves, and sediment transport) are not anticipated to be sufficient to influence identified marine archaeological receptors at this distance from Dublin Array Offshore Wind Farm.

## 13.20 Summary of effects

13.20.1 A summary of the effects presented within this EIAR chapter are presented in Table 39.

13.20.2 The column outlining additional mitigation measures is outlining those needed in addition to the avoidance and preventative measures in the project design (Section 13.13).

Table 39 Summary of effects for marine archaeology

| Description of effect | Effect | Additional mitigation measures | Residual effect |
|---|---|---|---|
| Construction | | | |
| Impact 1 | Removal of sediment containing undisturbed marine archaeological receptors during seabed preparation for WTG and OSP foundations. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Impact 2 | Intrusion of piling foundations causing penetration and compression on stratigraphic contexts containing marine archaeological receptors. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Impact 3 | Compression of stratigraphic contexts containing marine archaeological receptors from combined weight of WTG and OSP foundation, transition piece and tower. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Impact 4 | Disturbance of sediment containing potential marine archaeological receptors during the laying of inter-array cables and export cable laying operations. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Impact 5 | Penetration and compression effects of jack-up vessels and anchoring of construction vessels during WTG, OSP, or cable installation on marine archaeological receptors. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Operation and maintenance | | | |
| Impact 6 | Scour effects caused by the presence of WTG and OSP foundations, causing, or accelerating loss of marine archaeological receptors. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Impact 7 | Remedial burial of inter-array and export cables that become exposed and | Not applicable – no additional | No significant adverse residual effects on marine |

| Description of effect | Effect | Additional mitigation measures | Residual effect |
|---|---|---|---|
| | replacement of damaged cables. | mitigation identified | archaeological receptors |
| Impact 8 | Penetration and compression effects caused by corrective and preventative operation and maintenance activities (via jack-up vessels or anchors) on marine archaeological receptors. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Decommissioning | | | |
| Impact 9 | Draw-down of sediment into voids left by removed WTG and OSP foundations leading to loss of sediment, causing, or accelerating loss of marine archaeological receptors. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Impact 10 | Penetration and compression effects of jack-up vessels and anchoring of decommissioning vessels on marine archaeological receptors. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Cumulative effects | | | |
| Impact 11 | Disturbance of sediment containing potential marine archaeological receptors during all phases of Dublin Array Offshore Wind Farm. | Not applicable – no additional mitigation identified | No significant adverse residual effects on marine archaeological receptors |
| Transboundary | | | |
| No transboundary effects have been identified. | | | |

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# Dublin Array Offshore Wind Farm

## Environmental Impact Assessment Report

### Annex A: Marine Archaeology Policy

## Legislation, Policy and Guidance

| Policy/ Legislation | Key provisions | Section where provision is addressed |
|---|---|---|
| **Legislation** | | |
| European Communities (Marine Strategy Framework) Regulations 2011 (S.I. No. 249 of 2011) | Pressures and Impacts:<br>57. Physical loss<br>58. Permanent loss of cultural heritage assets from compression or penetration impacts of infrastructure<br>59. Physical damage<br>60. Damage to cultural heritage assets from impacts caused by compression, penetration or sediment movement. | The pressures and impacts outlined in Schedule 1, Table 2 of the Regulations were considered in the development of the scope of this assessment.<br><br>The potential for physical loss or damage is addressed in the impact assessment in Sections 13.14 to 13.20. |
| Planning and Development Regulations, 2001, as amended (S.I. No. 600/2001) Schedule 6, Part2 (b) | "a description of the aspects of the environment likely to be significantly affected by the proposed development, including in particular: … - soil, water, air, climatic factors and the landscape" | This assessment provides a description of the likely significant effects on the physical processes and seabed sediments in conjunction with Volume 3, Chapter 2: Marine Water and Sediment Quality. |
| **Guidelines and technical standards** | | |
| Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Government, 2018) (hereafter referred to as the EIA Guidelines) | The starting point for EIA is an assessment of the current state of the environment and how this is likely to evolve without the proposed project but having regard to existing and approved projects and likely significant cumulative effects – in other words the 'do nothing' scenario. | A full characterisation of the receiving environment is presented in Volume 4, Appendix 4.3.1-1: Physical Processes Technical Baseline (referred to as the Physical Processes Technical Baseline). The findings of this characterisation have been summarised in this chapter for the ease of the reader. |

| Policy/ Legislation | Key provisions | Section where provision is addressed |
|---|---|---|
| Para 4.31. | | |
| Guidance on Environmental Impact Statement (EIS) and Natura Impact Statement (NIS) Preparation for Offshore Renewable Energy Projects (Environmental Working Group of the Offshore Renewable Energy Steering Group and the Department of Communications, Climate Action and Environment, 2017) (hereafter referred to as the DCCAE Guidance) | “Cumulative impact assessments only need to take account of existing and/or approved projects and not other projects within the planning process.” | A precautionary approach was undertaken to consider and plans or projects which could result in a cumulative effect. The cumulative assessment is presented in Section 13.17 of this chapter. To account for the uncertainty associated with projects and plans which have not yet been consented a tiering system was adopted. Further details of the approach are available in Volume 2, Chapter 4: Cumulative Impact Assessment Methodology. |
| DCCAE Guidance, 2017<br><br>Table 3 | “Environmental protection by assessment of likely significant effects of projects to promote sustainable development” | The scope of this assessment is presented in Section 13.11. All effects which have been assessed were identified, in the Dublin Array Scoping Report, with the potential to arise in significant effects in EIA terms. |
| DCCAE Guidance, 2017<br>Table 4 | “developers and competent authorities should have regard to when planning/assessing a project –<br>61. Protected sites and species “ | An assessment of the potential changes in the physical processes on protected sites and species is presented in the Natura Impact Statement (NIS) (Part 4: Volume 2: NIS) |

| Policy/ Legislation | Key provisions | Section where provision is addressed |
|---|---|---|
| DCCAE Guidance, 2017<br>Table 4 | "developers and competent authorities should have regard to when planning/assessing a project –<br>Coastal erosion" | An assessment of the potential changes to coastal erosion and the associated implications are presented Sections 13.14 to 13.16. |
| DCCAE Guidance, 2017<br>Table 4 | "developers and competent authorities should have regard to when planning/assessing a project –<br>62. Sedimentation processes" | An assessment of the potential changes to coastal erosion and the associated implications are presented Sections 13.14 to 13.16 |
| DCCAE Guidance, 2017<br>Table 4 | "developers and competent authorities should have regard to when planning/assessing a project –<br>Seabed geology and morphology " | An assessment of the potential changes to the seabed geology and morphology and the associated implications are presented Sections 13.14 to 13.16. |
| DCCAE Guidance, 2017<br>Table 4 | "developers and competent authorities should have regard to when planning/assessing a project –<br>Bathymetry and hydrography " | An assessment of the potential changes to water depth and hydrography and the associated implications are presented Sections 13.14 to 13.16. |
| DCCAE Guidance, 2017<br>Table 4 | "developers and competent authorities should have regard to when planning/assessing a project –<br>Sediments " | An assessment of the potential changes to marine sediment composition and suspended concentrations are presented Sections 13.14 to 13.16. |
| DCCAE Guidance, 2017<br>Section 3.2 | "All phases of the development should be considered in the assessment process. Each of these phases will have its own specific effects on the environment and will differ in duration. Considering all phases of the development will address full *lifecycle* effects of a proposed development." | All phases of the development have been considered within this physical process EIA assessment.<br><br>The assessment of effects in the construction phase are presented in Section 13.14.<br><br>The assessment of effects in the operational phase (including |

| Policy/ Legislation | Key provisions | Section where provision is addressed |
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| | | maintenance) are presented in Section 13.15.<br><br>The assessment of effects in the decommissioning phase are presented in Section 13.16. |
| DCCAE Guidance, 2017<br>Section 4.5.3 | "The zones of influence may differ depending upon the topic under consideration (e.g. the visual zone will differ from the biodiversity zone). In establishing the zones of influence, the following should be identified:<br>63. the physical footprint of the project;<br>64. the measures required to determine the overall zones of influence of a project (i.e. the area impacted by the development with reference to the of likely significant effects); and<br>65. the study area (i.e. that selected for the review).<br><br>Specific modelling techniques, typically simulating water mixing processes to predict temporal and spatial variations, can be used to assist in the exercise. The zones of influence relate primarily to ecological and visual impacts of the development." | The Zone of Influence (ZoI) for Dublin Array on the physical marine environment was developed through use of project specific modelling. Further details of the ZoI and the development of the study area is presented in Section 0. |
| DCCAE Guidance, 2017<br>Section 4.5.3 | "A source – pathway – target risk assessment methodology may be of benefit in establishing the potential zones of influence." | A source-pathway-receptor assessment methodology was used to scope the receptors within the ZoI for this assessment - see Section 13.12 for those receptors scoped in for assessment. |
| DCCAE Guidance, 2017<br>Section 4.6.3 | "A description of the existing environment is required to allow for a prediction of significant likely effects of a development. " | A full characterisation of the receiving environment is presented in the Physical Processes Technical Baseline. The findings of this characterisation have been summarised in this chapter for the ease of the reader. |
| DCCAE Guidance, 2017 | "The *condition* of the receiving environment should be used to inform whether or not an effect is significant and to understand its vulnerability and sensitivity." | The assessment criteria for assessing the sensitivity of receptor to a potential effect |

| Policy/ Legislation | Key provisions | Section where provision is addressed |
|---|---|---|
| Section 4.6.3 | | is outlines in Section 13.5. The criterion including a consideration of its context (its adaptability, tolerance and recoverability) and value. |
| DCCAE Guidance, 2017<br><br>Section 4.6.5 | Mitigation measures are usually required where likely significant effects on the environment are identified. Mitigation measures may be proposed in order to *avoid, prevent, reduce, rectify,* or sometimes *compensate* any major adverse effects. The impact of residual effects should then be assessed. | The avoidance and preventative measures relevant to this marine archaeology assessment is presented in Table 7. Where significant adverse effects arose (with the avoidance and preventative measures in place) then additional mitigation measures have been proposed and the effects have been reassessed with the mitigation measures in place to determine the residual effect – see Sections 13.14 and 13.16. |
| Guidelines on the Information to be contained in Environmental Impact Assessment reports (Environmental Protection Agency, 2022) (hereafter referred to as the Guidelines) | "The Guidelines have been drafted with the primary objective of improving the quality of EIARs with a view to facilitating compliance (with the [EIA] Directive). By doing so they contribute to a high level of protection for the environment through better informed decision-making processes. They are written with a focus on the obligations of developers who are preparing EIARs."<br><br>"The Guidelines emphasise the importance of the methods used in the preparation of an EIAR to ensure that that the information presented is adequate and relevant." | The methodology presented within the draft Guidelines was utilised in the development of the EIA methodology applied within this EIAR. Further details are provided in Volume 2, Chapter 3: EIA Methodology. |

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