

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Environmental Statement

Volume 4, Annex 8.1: Marine archaeology technical report

Planning Inspectorate Reference Number: EN010136

Document Number: MRCNS-J3303-RPS-10075

Document Reference: F4.8.1

APFP Regulations: 5(2)(a)

April 2024

F01



Image of an offshore wind farm

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Application	RPS	Morgan Offshore Wind Ltd.	Morgan Offshore Wind Ltd.	April 2024

Prepared by:

RPS

Prepared for:

Morgan Offshore Wind Ltd.

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Glossary

Term	Meaning
Fluvial	Of, or relating to, a river or stream; Or produced by the action of a river or stream.
Gazetteer	A geographical index or dictionary.
Glaciofluvial	Sediments from glacial regions transported and deposited by streams and rivers.
Glaciolacustrine	Sediments deposited into lakes that have come from glaciers are called glaciolacustrine deposits. These lakes include ice margin lakes or other types formed from glacial erosion or deposition. Sediments in the bedload and suspended load are carried into lakes and deposited.
Glaciomarine	An environment containing both glacial ice and marine water.
Lacustrine	Sediments deposited into lakes.
Moraine	Unconsolidated geological debris from current and formerly glaciated regions.
Nadir	The lowest or most unsuccessful point.
Palaeoenvironmental	An environment of a past geological age.
Palaeosol	A soil formed in the past that has no relationship in chemical or physical characteristics to the present-day climate or vegetation.

Acronyms

Acronym	Description
AAIs	Areas of Archaeological Importance
AD	Anno Domini
ADS	Archaeology Data Service
AHEF	Archaeology and Heritage Engagement Forum
AMAPs	Areas of Maritime Archaeological Potential
BC	Before Christ
BGS	British Geological Survey
BLF	Bardsey Loom Formation
BP	Before Present
CBF	Cardigan Bay Formation
CPT	Cone Penetration Test
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
FBF	Caernarfon Bay Formation
HSC	Historic Seascape Characterisation
MCA	Maritime and Coastguard Agency
MBES	Multi-beam Echo Sounder
MNH	Manx National Heritage

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Acronym	Description
MOD	Ministry of Defence
MPS	Marine Policy Statement
NMRW	National Monuments Record Wales
NRHE	National record of the Historic Environment
NWMP	North West Marine Plan
PAD	Protocol for Archaeological Discoveries
PEIR	Preliminary Environmental Information Report
PWA	The Protection of Wrecks Act
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
RoW	Receiver of Wreck
SBP	Sub-bottom Profiler
SL	Sediment Layer
SL2	Sediment Layer 2
SSS	Side Scan Sonar
STG	St George's Channel Formation
TAEZ	Temporary Archaeological Exclusion Zone
UHRS	Ultra High Resolution Seismic
UKHO	United Kingdom Hydrographic Office
USBL	Ultra Short Baseline
WCPS	West Coast Palaeolandscape Study
WIS-A	West Irish Sea Formation A
WIS-B	West Irish Sea Formation B
WWI	World War I
WWII	World War II
WSI	Written Scheme of Investigation

Units

Unit	Description
%	Percentage
km	Kilometres
km ²	Square kilometres
m	Metres
nm	Nautical miles (distance; 1 nm = 1.852 km)

1 Marine archaeology technical report

1.1 Introduction

1.1.1.1 This marine archaeology technical report presents baseline information as part of the Environmental Impact Assessment (EIA) process in relation to the Morgan Offshore Wind Project: Generation Assets (hereafter referred to as the Morgan Generation Assets) in the east Irish Sea region in order to inform the Environmental Statement.

1.1.1.2 The aim of this marine archaeology technical report is to provide an overview of the archaeological baseline associated with the Morgan Generation Assets.

1.1.1.3 The objectives of this report are to:

- Summarise the potential for submerged prehistoric archaeology to be encountered within the Morgan marine archaeology study area (Figure 1.1)
- Identify known maritime and aviation sites and based on the maritime history of the Morgan marine archaeology study area and the wider area, assess the potential for the existence of unknown sites and materials within the limits of the Morgan marine archaeology study area
- Present site-specific geophysical data from surveys across the Morgan marine archaeology study area that identify anomalies of archaeological interest and characterise these anomalies integrating the results of the site-specific data, with the findings of the desktop study described in section 1.3.2
- Review available site-specific geophysical and geotechnical data of the Morgan marine archaeology study area for sediments of archaeological and paleoenvironmental interest and integrate the results with the findings of the desktop study.
- Establish the Historic Seascape Character (HSC) of the Morgan marine archaeology study area.

1.2 Legislation, policy and guidance

1.2.1 Overview

1.2.1.1 This section sets out the legislation, policy, guidance and any development plans relevant to marine archaeology in the context of offshore renewable energy development.

1.2.1.2 With regard to marine licensing, UK territorial waters is classed as the area of sea within the limits 12 nm of the territorial coastline. This also includes any area of sea beyond 12 nm that is within the Exclusive Economic Zone (EEZ) and the UK sector of the continental shelf (up to 200 nm). This excludes the waters of any devolved administration. The Morgan Generation Assets is situated wholly within UK territorial waters.

1.2.1.3 Beyond the UK's territorial waters archaeology is generally subject to international legislation and policy, with two exceptions:

- The Merchant Shipping Act 1995
- The Protection of Military Remains Act 1986.

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- 1.2.1.4 Outside the UK territorial waters the regulation and reporting of marine archaeology is governed by international legislation and guidance, such as the United Nations Convention on the Law of the Sea 1982 (UNCLOS), the European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (the Valletta Convention) and the United Nations Educational, Scientific and Cultural Organisation's Convention on the Protection of Underwater Cultural Heritage 2001 (UNESCO).

1.2.2 Legislation

Protection of Wrecks Act 1973

- 1.2.2.1 Section one of the Protection of Wrecks Act 1973 (PWA) states that wrecks and wreckage of historical, archaeological or artistic importance can be protected by way of designation and that it is an offence to carry out certain activities in a defined area surrounding a wreck that has been designated, unless a licence for those activities has been obtained. Section two of PWA provides protection for wrecks that are designated as dangerous due to their contents and is administered by the Maritime and Coastguard Agency (MCA) through the Receiver of Wreck (RoW).

Ancient Monuments and Archaeological Areas Act 1979 (as amended)

- 1.2.2.2 This Act is primarily land based, but in recent years it has also been used to provide some level of protection for underwater sites. Scheduled Monuments and Areas of Archaeological Importance (AAIs or their equivalent) are afforded statutory protection by the Secretary of State, and consent is required for any works. The law is administered by the Secretary of State within the Department of Culture, Media and Sport generally via their statutory advisor's.

Protection of Military Remains Act 1986

- 1.2.2.3 Under the Protection of Military Remains Act 1986, all aircraft that have crashed in military service are automatically protected. Maritime vessels lost during military service are not automatically protected although the Ministry of Defence (MOD) has powers to protect any vessel that was in military service when lost. The MOD can designate 'controlled sites' around wrecks whose position is known and can designate named vessels as 'protected places' even if the position of the wreck is not known. It is not necessary to demonstrate the presence of human remains at either 'controlled sites' or 'protected places'. The provisions of the Protection of Military Remains Act 1986 regarding Controlled Sites are applicable in international waters, though they are only enforceable with respect to British-controlled ships, British citizens and British companies.

The Merchant Shipping Act 1995

- 1.2.2.4 This Act details the procedures for determining the ownership of maritime finds that turn out to be 'wreck' offshore, onshore including the intertidal zone of UK territorial waters. It includes all craft, parts of these, their cargo or equipment. If any maritime finds are brought onshore the RoW must be notified, and the finds must be kept until the RoW determines ownership or requests that they be given to the RoW. The act is administered by the MCA.

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- 1.2.2.5 Beyond the 12 nm limit the Merchant Shipping Act 1995 covers wreck found or taken into possession outside UK waters and stipulates that, if brought into UK waters, finds must be reported to the RoW.

1.2.3 Policy

National Policy Statements

- 1.2.3.1 NPS EN-1 (Overarching National Policy Statement for Energy) and NPS EN-3 (National Policy Statement for Renewable Energy Infrastructure) include guidance on what is to be included in the Environmental Statement and as such they are described in detail in Volume 2, Chapter 8: Marine archaeology and cultural heritage of the Environmental Statement.

Marine Policy Statement 2011

- 1.2.3.2 The Marine Policy Statement (MPS) was published by all UK governments in March 2011 as part of a system of marine planning across UK seas. The MPS is the overarching framework for preparing Marine Plans and making decisions affecting the marine environment. The MPS also states that Marine Plans must ensure a sustainable marine environment that will protect heritage assets.
- 1.2.3.3 Section 2.6.6 of the MPS relates to the historic environment in marine planning and advises that heritage assets should be conserved through marine planning in a manner appropriate and proportionate to their significance. It advises that when considering the significance of a heritage asset and its setting, the marine plan authority should take into account the particular nature of the interest in the assets and the value they hold for this and future generations.
- 1.2.3.4 Designated archaeological assets in coastal/intertidal zones and inshore/offshore waters may include scheduled monuments, designated wrecks and sites designated under the Protection of Military Remains Act 1986. Non-designated archaeological assets of equivalent status should be considered under the same policy principles as designated archaeological assets.
- 1.2.3.5 Where the loss of the whole or material part of an archaeological asset's significance is justified, suitable mitigation measures should be put in place.

North West Marine Plan

- 1.2.3.6 The North West Marine Plan (NWMP) (UK Government, 2021) has been prepared for the purposes of Section 51 of the Marine and Coastal Access Act 2009. The NWMP applies national policies in a local context and should enable activities to move more quickly from concept to consent and earlier identify proposals that are inappropriate or unfeasible.
- 1.2.3.7 Section 3.2 of the NWMP relates to a 'mitigation hierarchy' to manage adverse impacts on other marine users or environmental receptors. With regards to heritage assets, the NWMP states that:
- 1.2.3.8 *'Proposals that demonstrate they will conserve and enhance the significance of heritage assets will be supported. Where proposals may cause harm to the significance of heritage assets, proponents must demonstrate that they will, in order of preference: a) avoid; b) minimise; c) mitigate any harm to the significance of heritage assets. If it is not possible to mitigate, then public benefits for proceeding with the*

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proposal must outweigh the harm to the significance of heritage assets’ (UK Government, 2021).

- 1.2.3.9 The policy aim with regards to heritage assets is to *‘conserve and enhance marine and coastal heritage assets by considering the potential for harm to their significance. This consideration will not be limited to designated assets and extends to those non-designated assets that are or have the potential to become significant. The policy will ensure that assets are considered in the decision-making process and will make provisions for those assets that are discovered during developments’ (UK Government, 2021).*

1.2.4 Guidance

- 1.2.4.1 There are a number of guidance documents that are relevant to marine archaeology in the context of offshore renewable development, which have been considered in the production of this technical report, these include:

- International:
 - The World Heritage Convention 1972
 - United Nations Convention on the Law of the Sea 1982
 - International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage 1996 (the Sofia Charter)
 - UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001
 - European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (the Valletta Convention)
 - European Directive for Environmental Impact Assessments (2014/52/EU)
 - Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC) 2006).
- UK:
 - Code of Conduct (Chartered Institute for Archaeologists, 2014)
 - Standard and Guidance for Historic Environment Desk Based Assessment (Chartered Institute for Archaeologists, 2014 (updated 2020))
 - COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007a)
 - Offshore Renewables Protocol for Archaeological Discoveries (The Crown Estate, 2014)
 - Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2010)
 - Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (Wessex Archaeology for The Crown Estate, 2021)
 - Principles of Cultural Heritage Impact Assessment in the UK (IEMA, IHBC and ClfA, 2021)

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- Environmental Archaeology, A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition) (Historic England, 2011)
- Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Historic England, 2013)
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008)
- Commercial Renewable Energy Development and the Historic Environment. Historic England Advice Note 15 (Historic England, 2021)
- Deposit Modelling and Archaeology: Guidance for mapping buried deposits (Historic England, 2020)
- Radiocarbon Dating and Chronological Modelling (Historic England, 2022)
- Environmental Archaeology, A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition) (Historic England, 2011)
- Marine Geophysical Data Acquisition, Processing, and Interpretation – guidance notes (Historic England, 2013).
- Historic Seascape Characterisation (HSC). The Irish Sea (English Sector), Section One: Background Methodology and Results (Newman, 2011).
- An Approach to Seascape Character Assessment (Natural England, 2012).

1.2.5 Consultation

- 1.2.5.1 A summary of the key comments raised during consultation activities undertaken to date specific to marine archaeology is presented in Table 1.1.

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Table 1.1: Summary of key matters raised during consultation activities undertaken for the Morgan Generation Assets relevant to marine archaeology.

Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
30 November 2022	Cadw. Archaeology and Heritage Engagement Forum (AHEF) meeting.	Geophysical analysis may have significant implications requiring consultation and the stakeholders cannot be put in the position of having insufficient time to review documents with such significant implications. Geophysical assessment of cable corridors needs to be delivered to stakeholders ASAP and before the Environmental Statement. If the Impact Assessment is not appropriate that could/would invalidate the project application.	<p>This marine archaeology technical report concerns the Morgan Generation Assets, which includes the wind turbines, inter-array cables, interconnector cables, and offshore substation platforms (OSPs). Geophysical surveys were undertaken between July 2021 and March 2022, the results of which are presented in section 1.5.8.</p> <p>A summary of the results of the Stage 1 geoarchaeological assessment is included within section 1.4.2 and discussed in the context of submerged palaeoarchaeological potential in section 1.4.3.</p> <p>The results of these surveys and assessments were also included at Preliminary Environmental Information Report (PEIR).</p>
30 November 2022	Historic England. AHEF meeting.	The Isle of Man territorial waters run right up to the Morgan Array Area boundary, is there adequate collaboration and coordination with the IoM.	<p>Manx National Heritage (MNH) have been contacted with a request to purchase the shipwreck data on 07 July 2023, 19 July 2023, and 30 October 2023. A list of records was supplied by MNH and cross-checked with the other datasets (see Table 1.2).</p> <p>The potential to find archaeological receptors near the boundary within the Isle of Man territorial waters is noted and will be addressed in the Outline Written Scheme of Investigation (WSI) (Document Reference J14).</p>

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
30 November 2022	Historic England. AHEF meeting.	What geotechnical data was obtained? Do we have viable samples?	In 2022, Fugro Marine Limited and Gardline conducted geotechnical surveys within the Morgan Generation Assets. Stage 1 evaluation was completed in 2023 by COARS (2023). Stage 1 evaluation consists of a geoarchaeological review of core logs comprising a desk-based assessment of geotechnical core logs and recommendations as to which cores should be subject to visual inspection and recording by a geoarchaeologist in Stage 2. A summary of the results of the Stage 1 geoarchaeological assessment is presented in section 1.4.2 and discussed in the context of submerged palaeoarchaeological potential in section 1.4.3.
16 March 2023	Historic England. AHEF meeting.	What indication can you provide of the other anomalies that aren't already known and identified. Have anomalies been compared with recorded losses?	All anomalies are presented in section 1.5.8 and have been cross-checked against desktop data sources. Recorded losses are not associated with reliable positional data (section 1.5.4) and therefore it would not be reliable to corroborate these records with anomalies identified at this stage.

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
31 May 2023	Historic England. PEIR response.	We are aware that survey data analysis is ongoing of geophysical and geotechnical survey data acquired in 2022 and that further archaeological and geoarchaeological interpretation should be included within the Environmental Statement.	<p>Geophysical surveys were undertaken between July 2021 and March 2022, the results of which are presented in section 1.5.8.</p> <p>Stage 1 geotechnical evaluation was completed in 2023 by COARS (2023). Stage 1 evaluation consists of a geoarchaeological review of core logs comprising a desk-based assessment of geotechnical core logs and recommendations as to which cores should be subject to visual inspection and recording by a geoarchaeologist in Stage 2. A summary of the results of the Stage 1 geoarchaeological assessment is included in section 1.4.2 and discussed in the context of submerged palaeoarchaeological potential in section 1.4.3.</p>

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
31 May 2023	Historic England. PEIR response.	<p>We note that physical processes modelling conducted for this project has indicated that changes to the tidal regime are limited to the immediate development area. It is therefore anticipated that marine physical processes beyond the 2 km marine archaeology study area are “minimal” i.e., “negligible”. Regarding section 13.2.4 (Guidance) we also offer the following:</p> <ul style="list-style-type: none"> • Historic England Advisory Note (No 15) Commercial Renewable Energy • Development and the Historic Environment (2021) • Deposit Modelling and Archaeology • Radiocarbon Dating and Chronological Modelling. 	<p>The recommended guidance was considered where appropriate in the production of this Marine archaeology technical report and Volume 2, Chapter 8: Marine archaeology and cultural heritage of the Environmental Statement.</p> <p>Information relating to physical processes are presented in Volume 2, Chapter 1: Physical processes of the Environmental Statement.</p>

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
31 May 2023	Historic England. PEIR response.	Paragraph 13.4.4.23 highlights a potential aircraft crash site record held by the United Kingdom Hydrographic Office (Ref: 5418) and National Record of the Historic Environment (Ref: 909495) within the Morgan marine archaeology study area and considered 'live' by the United Kingdom Hydrographic Office (UKHO). If a crashed military aircraft is present and identified as being British, then it will be automatically afforded 'protected place' status under the Protection of Military Remains Act 1986.	It is unknown from the data whether this was a military aircraft, and no material of anthropogenic origin has been identified at this location in the geophysical data. As a precautionary approach, a Temporary Archaeological Exclusion Zone (TAEZ) of 100 m radius from the UKHO coordinates has been recommended (see section 1.5.5).
31 May 2023	Historic England, PEIR response.	Paragraph 13.4.5.2 acknowledges that dynamic seabed conditions means that there is potential for archaeological sites to be exposed or buried including "new marine archaeology sites and wrecks..." and this matter is expanded upon in Section 13.4.6 (data limitations). It therefore continues to be our advice that professional archaeological analysis is commissioned for any further geophysical and geotechnical survey data acquired for the Morgan Generation Assets with the results included within any Environmental Statement subsequently produced.	Geophysical surveys were undertaken between July 2021 and March 2022, the results of which are presented in section 1.5.8. Stage 1 geotechnical evaluation was completed in 2023 by COARS (2023). Stage 1 evaluation consists of a geoarchaeological review of core logs comprising a desk-based assessment of geotechnical core logs and recommendations as to which cores should be subject to visual inspection and recording by a geoarchaeologist in Stage 2. The results of the Stage 1 evaluation is summarised in section 1.4.2.

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
31 May 2023	Historic England. PEIR response.	In our Scoping Response (July 2022) we made the comment that the Applicant should contact the national curator for the historic environment in the Isle of Man to support preparation of the PEIR. However, we note the comment made in Table 13.4 that no data appears to be held as relevant to the Morgan marine archaeology study area.	<p>MNH have been contacted with a request to purchase their newly acquired shipwreck data on 07 July 2023, 19 July 2023, 22 August 2023, and 30 October 2023. A list of records was supplied by MNH and cross-checked with the other datasets.</p> <p>The potential to find archaeological receptors near the boundary with the Isle of Man territorial waters is noted and are addressed in the Outline Offshore WSI and Protocol for Archaeological Discoveries (PAD) (Document Reference J14).</p>
31 May 2023	Historic England. PEIR response.	Section 1.2.2 (Legislation) includes Protection of Wrecks Act 1973 and Ancient Monuments and Archaeological Areas Act 1979 (as amended) although it is not explained why these acts are included in consideration that the entire proposed Morgan Generation Assets is within the North West Offshore Marine Plan Area. Furthermore, in section 1.2.3 (Policy) the explanation in paragraph 1.2.3.3 requires further clarification that “Designated archaeological assets” can only occur within the English Inshore Marine Planning Area. In section 1.2.4 (Guidance) we offer the additional reference Historic England Advisory Note Commercial Renewable Energy Development and the Historic Environment, as referenced above.	The North West Marine Plan is discussed in section 1.2.3, and the Historic England Advisory Note is referenced in section 1.2.4. However, there is no policy or guidance that suggest that designated archaeological assets can only occur within the English Inshore Marine Planning Area.

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
31 May 2023	Historic England. PEIR response.	Section 1.5.2 (Historic Seascape Characterisation) while we note the use of HSC to provide context for the archaeology study and the identification of historic character as “...predominantly related to fishing and navigation activity” and that there is “a high potential for maritime archaeology” it does not appear to include an assessment of how these perceptions of historic character can accommodate change as presented by this proposed development. We require this matter to be considered further within the Environmental Statement.	The HSC baseline is presented in section 1.5.2. Effects on HSC are assessed and presented in Volume 2, Chapter 8: Marine archaeology and cultural heritage of the Environmental Statement.
02 June 2023	Isle of Man Department of Infrastructure. PEIR response.	The potential direct impact on historical shipwrecks would also need to be assessed. MNH has recently acquired some shipwreck data and whilst this is still being evaluated and integrating it into MNH data system, it is already clear that there are several sites in the area. None of them are formally protected so as to cause a significant problem, but nevertheless MNH would expect an EIA to exercise due diligence in this respect.	<p>MNH have been contacted with a request to purchase their newly acquired shipwreck data on 07 July 2023, 19 July 2023, 22 August 2023, and 30 October 2023. A list of records was supplied by MNH and cross-checked with the other datasets.</p> <p>The potential to find archaeological receptors near the boundary with the Isle of Man territorial waters is noted and are addressed in the Outline Offshore WSI and PAD (Document Reference J14).</p>

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Date	Consultee and type of response	Comments	Response to comments raised and/or where considered in this technical report
13 July 2023	Historic England. AHEF meeting.	Key element of HSC is that it can't be equated to sensitivity and therefore assessed as a receptor. It is more of a narrative approach, acknowledging perception of historical character, what exists and what more is being introduced by the proposed development. I.e. Industrial seascape (e.g. oil and gas) is then able to accommodate further iteration of industrial development (e.g. offshore wind), contrary to 'pristine' seascapes which were, historically, less industrialised and therefore less able to accommodate industrial development.	HSC is presented in section 1.5.2. Effects on HSC are assessed and presented in Volume 2, Chapter 8: Marine archaeology and cultural heritage of the Environmental Statement.
13 October 2023	Applicant/Historic England. AHEF meeting	Applicant desires to mitigate impact on the post-consent compliance programme. The intention being to submit full details of post-consent geophysical surveys for approval at consent in order to have 'Day 1' approval of the survey. HE acknowledges this desire to have concurrent approval of development consent and for post-consent survey, and that this would be a focus of attention. HE are happy with this approach but stressed the importance of what information is included in the Outline Offshore WSI, and the compliance with working practices for how such documents inform post-consent work packages. The intention for concurrent approval is fine in principle from HE's perspective.	The Outline Offshore WSI and PAD (Document Reference J14) presents details in relation to any future surveys planned as part of Morgan Generation Assets. No surveys that will impact the seabed and therefore could have the potential to impact archaeological material are proposed immediately post consent. Method Statements will be produced and submitted to HE for approval, as required prior to any post consent site investigations.

1.3 Methodology

1.3.1 Morgan marine archaeology study area

- 1.3.1.1 The Morgan marine archaeology study area consists of the Morgan Array Area with an additional 2 km buffer. This is shown in Figure 1.1. This was used as the search area for obtaining records from relevant archive databases. This wider Morgan marine archaeology study area allows for a greater understanding of the archaeological baseline environment, with the dual purpose of enabling any archaeological trends within the region to be recognised and to allow any archaeological sites identified to be represented in a broader archaeological context.

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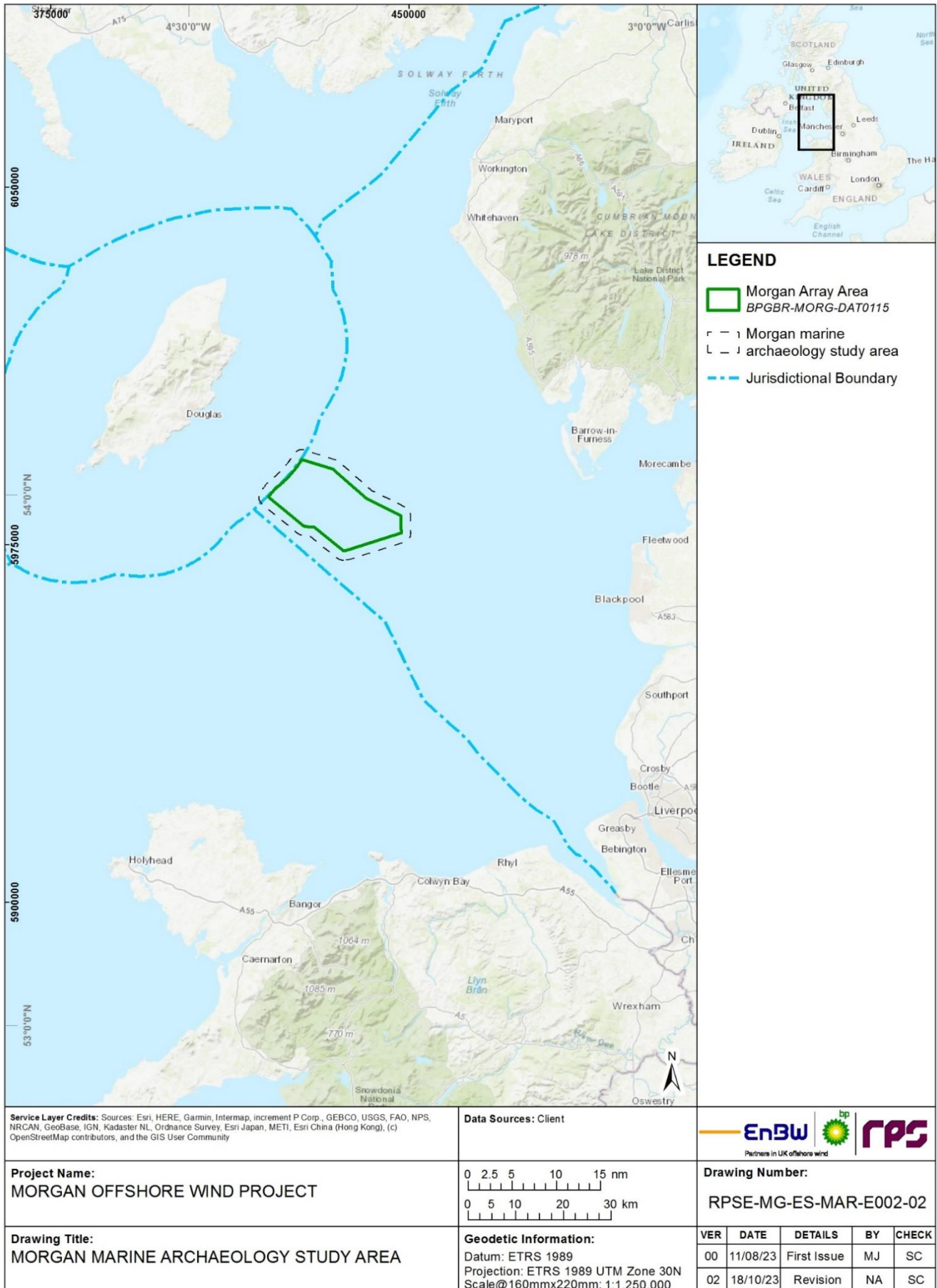


Figure 1.1: Morgan Generation Assets and Morgan marine archaeology study area (2 km buffer).

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1.3.2 Desktop study

1.3.2.1 Marine archaeology is considered within the following categories:

- Submerged prehistoric archaeology: This includes paleochannels and other inundated terrestrial landforms that may preserve sequences of sediment of paleoenvironmental interest, Palaeolithic and Mesolithic sites and artefacts
- Maritime archaeology: relates generally to craft or vessels and any of their associated structures and/or cargo
- Aviation archaeology: this comprises all military and civilian aircraft crash sites and related wreckage
- HSC: characterisation of the historic and present physical, environmental and human made changes and activities that have formed the seascape as it is today.

Data sources

1.3.2.2 A number of sources were consulted in order to inform this desktop study of the Marine Archaeology Technical Report and are provided in Table 1.2. The principal archaeological archives relating to the Morgan marine archaeology study area are the National Record of the Historic Environment (NRHE) as held by HE. Data from the UKHO is a further resource, which RPS holds in house, and is utilised to corroborate positional information of known wrecks and obstructions on the seabed. Additional sources consulted include the National Monuments Record Wales (NMRW) as held by Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW), historic Ordnance Survey maps and Admiralty Charts. MNH provided additional shipwreck data from within the Morgan marine archaeology study area.

Table 1.2: Summary of key desktop sources.

Title	Source	Year	Author
UKHO Wreck and Obstructions Data	UKHO	2022	UKHO
Historic Environment Record Data	National Record of the Historic Environment (NRHE)	2021	Historic England
Historic Environment Record Data	National Monuments Record Wales (NMRW)	2021	RCAHMW
HER Shipwreck Data	MNH	2023	MNH
Historic Seascape Characterisation: The Irish Sea (English Sector)	Archaeology Data Service (ADS)	2011	Historic England
Submerged Landscapes Data	EMODnet Geology	2022	British Geological Survey

1.3.2.3 The data available for the submerged prehistoric archaeology assessment includes:

- Ultra High Resolution Seismic (UHRS) data acquired with a line spacing of 250 m with cross lines every 500 m, and a vertical resolution of 1 m. Collected for the Morgan Generation Assets.

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- Shallow Cone Penetration Test (CPT) data
- Legacy boreholes and oil and gas wells
- Ground model outputs, currently based on interpretation of the UHRS data, including:
 - Wood (2022): Technical File Note Preliminary Ground Model Morgan & Mona Windfarm Development Irish Sea
- Five boreholes and 12 cores previously taken within the Morgan marine archaeology study area by the British Geological Society (BGS)
- Seismic surveys previously undertaken within the Morgan marine archaeology study area by the BGS
- Mona and Morgan Offshore Wind Farm Stage 1 Geoarchaeological Assessment (Coastal and Offshore Archaeology Research Services (COARS), 2023).

1.3.2.4 Previous development led studies have also been incorporated into the assessment. Geoarchaeological review cores collected within the nearby Walney extension offshore wind farm which lies c. 7.5 km to the northeast of the site (MSDS Marine, 2019). Further to this, a review of prehistoric archaeological remains within Strategic Environmental Assessment Area 6 (SEA6) which partially covers the Morgan marine archaeology study area was undertaken in 2005 (Flemming, 2005).

Data structure

1.3.2.5 In order to compile a marine archaeological baseline for the purposes of this Marine Archaeology Technical Report, these sources were compiled into gazetteers (Appendix A and Appendix B).

1.3.2.6 The historic environment records have been classified between records where material is known to be on the seabed and 'recorded losses'. Recorded losses are events of vessels that are known to have been lost in the area, but with which no accurately located remains are associated.

1.3.2.7 Where multiple entries across the datasets occur that relate to the same archaeological receptor, the coordinates from the UKHO dataset have been used, as they are most frequently updated with the latest survey positions.

1.3.3 Site-specific surveys

1.3.3.1 Survey data were collected across the Morgan Array Scoping Boundary area of 322 km² by Gardline between 09 July 2021 and 08 September 2021, and XOcean between 12 June 2021 and 16 March 2022. The data consisted of full coverage by Sidescan Sonar (SSS), Multibeam Bathymetry (MBES), and Sub-bottom Profiler (SBP). Limited Magnetometer data was collected at geotechnical sampling locations as part of the clearance process.

1.3.3.2 Geotechnical site investigations were conducted in 2022 by Fugro Marine Limited and Gardline within the Morgan Array Area. These investigations were in the form of vibrocore and borehole sampling. Fugro's (2022) deep (up to 70 m below the seabed) geotechnical site investigations resulted in the collection of 1127 downhole wireline push (WIP) samples, 17 downhole piston samples, 296 Fugro extended marine core barrel (FXMCB) core samples and 413 GeoborS cores, taken from 45 geotechnical borehole locations. The shallow geotechnical investigation was undertaken by

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Gardline (2022) comprising 66 locations for CPT and 66 for vibrocores (plus 28 repeats).

1.3.3.3 The results of the geoarchaeological analysis from the geotechnical data is provided in section 1.4.2.

Technical specifications

1.3.3.4 All geophysical data was collected to a specification that fulfils the requirements of section 3 of Archaeological WSI for Offshore Wind Farm Projects (Wessex Archaeology, 2021) and in accordance with the site-specific WSI produced in advance of the geophysical survey campaign (COARS, 2021).

1.3.3.5 Line spacing was approximately 250 m across the survey area for SSS and SBP data producing a minimum of 100% coverage, excluding the nadir. MBES data were collected at a line spacing to ensure 100% coverage with sufficient overlap of data. The equipment specification is shown in Table 1.3.

Table 1.3: Mobilised survey equipment.

Contractor	Vessel	Sidescan Sonar	UHRS	Pinger	MBES	USBL
Gardline	Ocean Resolution	Edgetech 4200 122/410kHz	AAE DuraSpark	GeoAcoustics 5430A	Kongsberg EM2040C	Kongsberg HIPAP 502
XOcean	XO-04, XO-05, XO-06, XO-11	N/A	N/A	N/A	Norbit Winghead B51s	N/A

1.3.3.6 The data were collected to a specification appropriate to achieve the following interpretation requirements:

- Sidescan Sonar: ensonification of anomalies > 0.3 m
- Multibeam Bathymetry: ensonification of anomalies > 2.0 m
- Sub-bottom Profiler: penetration was achieved up to 200 m with a vertical resolution of 1 m
- 2d UHRS: vertical resolution of 1 m
- All data were collected and referenced relative to ETRS89 UTM Zone 30N.

1.3.3.7 The SSS used an Ultra Short Baseline (USBL) positioning system to ensure positional accuracy throughout the survey. USBL ensures the actual position of the sensor is recorded, as opposed to when the position is estimated based upon the direction of the vessel and the amount of cable out (layback).

1.3.3.8 Although the accuracy of the USBL system is dependent on the angle, and the distance of the beacon from the transceiver, tolerances of between 0.5 m and 2.0 m can be achieved.

1.3.3.9 Positional accuracy is further increased through the correlation of the SSS dataset with the MBES dataset.

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Data quality

- 1.3.3.10 The data collected to inform the Morgan Generation Assets archaeological assessment was generally of average to good quality. In certain areas the SSS data showed interference along the outer edges. This was likely caused by the simultaneous use of other sensors. However, interference was mostly constrained to the outer edges of the data where there was not high frequency data coverage. The MBES data was affected by motion across much of the survey area, the impacts of which are amplified towards the edge of the data where the distance from the sensor to the seabed is greater. Due to the constrained nature of the sonar interference and motion-affected data quality, it is not considered that this has impacted the ability to undertake an effective archaeological assessment.
- 1.3.3.11 Small offsets were noted in places between the SSS and MBES data, however this is usual and positions for medium and high potential anomalies were always taken from the MBES data (Table 1.5).
- 1.3.3.12 The topography and geology of the Morgan Generation Assets survey extents meant some small areas were obscured by shadow within the SSS data. The MBES data were used to identify any anomalies which may have been hidden.
- 1.3.3.13 It was possible to view a range of high, medium and low potential contacts within the survey extents. Overall, the data were deemed suitable for archaeological interpretation. It must be noted that there is always the potential for contacts of archaeological potential to not be visible in the data, this possibility is increased in areas of poor data quality or variable topography.
- 1.3.3.14 Following data collection navigation and offsets were applied. The data were then quality controlled before being delivered to MSDS Marine to carry out the geophysical survey interpretation in the formats presented in Table 1.4.

Table 1.4: Data deliverables.

Sensor	Deliverables
Sidescan Sonar	Navigation corrected, unprocessed high and low frequency lines (.xtf) Georeferenced mosaic at 2 m resolution (.tif) Seabed features (.csv)
Multibeam Bathymetry	Navigation corrected, unprocessed points (.pts) Georeferenced mosaic at 2 m resolution (.tif) Seabed features (.csv)
Sub-bottom Profiler	Navigation corrected, unprocessed lines (.sgy) Navigation corrected, processed lines (.sgy) Horizon grids and unit interpretations (.grd/.shp)

- 1.3.3.15 In addition, MSDS Marine were provided with operations and interpretations reports produced by the survey contractor, and a seabed survey data model geo-database containing all information and data relating to the survey campaigns.

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Processing

- 1.3.3.16 The archaeological assessment of data was undertaken by a qualified and experienced maritime archaeologist with a background in geophysical and hydrographic data acquisition, processing and interpretation.
- 1.3.3.17 Following delivery of the required datasets, an initial review was undertaken to gain an understanding of the geological and topographic make-up of the survey area. Within the extent of the survey area the potential for variations in the seabed are high and can affect the interpretation of anomalies.
- 1.3.3.18 Whilst this report focuses on those anomalies identified within the boundaries of the Morgan Array Area, the purpose of the assessment is to characterise the historic environment and therefore all of the data collected was assessed even that which extended beyond the limits of the Morgan Array Area.

Sidescan sonar

- 1.3.3.19 SSS is considered the best tool for the identification of anthropogenic anomalies on the seabed due to the ability to ensonify small features and as such forms the basis of any archaeological assessment of data. SSS data in .xtf format were imported into Chesapeake SonarWiz 7.9 software, navigation and positioning were checked and corrected where required, and optimal gains were applied to ensure the consistent presentation of data.
- 1.3.3.20 Data were reviewed on a line by line basis, and all anomalies of potential anthropogenic origin identified and recorded. Records include at a minimum an image of the anomaly, dimensions, and a description. An archaeological potential was assigned to the anomaly following the criteria outlined in Table 1.5 below.
- 1.3.3.21 Following assessment of the individual lines, a mosaic was created and a Geotiff exported to allow for the checking of positional accuracy against the MBES data and to identify the extents of any anomalies that may have extended past the limits of individual lines.

Multibeam bathymetry

- 1.3.3.22 Due to the minimum anomaly detection size of MBES data being larger than that of SSS data, the primary use during archaeological assessment, outside of seabed characterisation, is the corroboration of anomalies identified within other datasets and the visualisation of anomalies that may otherwise be obscured by shadow.
- 1.3.3.23 Navigation corrected, but unprocessed, MBES data were provide to MSDS Marine as .xyz files, the data were imported in QPS Fledermaus where it was gridded and a hill-shaded surface applied, shading was adjusted to ensure the optimal presentation of data. The resulting 3-Dimensional image was viewed on a block-by-block basis, and all anomalies of potential anthropogenic origin identified and recorded.
- 1.3.3.24 Records include, at a minimum, an image of the anomaly, dimensions and a description. An archaeological potential was assigned to the anomaly following the criteria outlined in Table 1.5 below. Where the interpretation of an anomaly was unclear, the data were imported into point cloud visualisation software such as Cloud Compare, in order to view the un-gridded data. The gridded surface image was exported as a Geotiff to allow further assessment alongside other datasets.

Table 1.5: Criteria for the assessment of archaeological potential.

Potential	Characterisation
Low	An anomaly potentially of anthropogenic origin but that is unlikely to be of archaeological significance. Examples may include discarded modern debris such as rope, cable, chain or fishing gear, small, isolated anomalies with no wider context or small boulder-like features with associated magnetometer readings.
Medium	An anomaly believed to be of anthropogenic origin but that would require further investigation to establish its archaeological significance. Examples may include larger unidentifiable debris or clusters of debris, unidentifiable structures or significant magnetic anomalies.
High	An anomaly almost certainly of anthropogenic origin and with a high potential of being of archaeological significance. High potential anomalies tend to be the remains of wrecks, the suspected remains of wrecks or known structures of archaeological significance.

Assumptions and limitations

- 1.3.3.25 Data used to compile this report consists of primary geophysical survey data and secondary information derived from a variety of sources. The assumption is made that the secondary data, as well as that derived from other secondary sources, is reasonably accurate.
- 1.3.3.26 The records held by the UKHO, NRHE and NMRW and the other sources used in this assessment are not a record of all surviving cultural heritage assets, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these datasets is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown. In particular, this relates to buried archaeological features.
- 1.3.3.27 The interpretation of geophysical and hydrographic data is by its very nature, subjective. However, by using an experienced specialist who can analyse the form, size and characteristics of an anomaly, a reasonable degree of certainty can be achieved. Measurements can be taken in most data processing software, and whilst largely accurate, discrepancies can occur. Where there is uncertainty as to the potential of an anomaly or its origin, a precautionary approach is always taken to ensure the most appropriate mitigation for the historic environment is recommended, i.e. where there may be doubt, a higher archaeological potential will be assigned. There may be instances where a contact may exist on the seabed but not be visible in the geophysical data. This may be due to the anomaly being covered by sediment or being obscured from the line of sight of the sonar, or due to poor quality data.

1.4 Marine archaeological assessment: submerged prehistoric archaeology

1.4.1 Geology and seabed topography

- 1.4.1.1 The geological processes which form a sequence of seabed deposits provide baseline information to inform an understanding of the Morgan marine archaeology study area's submerged prehistoric archaeological potential. This section therefore describes the seabed geological sequence and seabed topography within the Morgan marine archaeology study area, as a foundation for the sections which follow. It has been

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informed by a characterisation of the results of the project specific geophysical surveys, as described in section 1.3.3, and by relevant documentary sources.

- 1.4.1.2 The Morgan marine archaeology study area lies within the east Irish Sea. Bedrock comprises Triassic material, including the Sherwood Sandstone Group and Mercia Mudstone Group. Erosive events have affected the geomorphology of the Morgan marine archaeology study area. Large-scale valleys have been incised into the Mercia Mudstone bedrock in the east of the Morgan Array Area, whilst the west of the site shows less evidence of glacial phases due to the presence of the stronger Sherwood Sandstone bedrock. The valleys in the eastern area of the Morgan Array Area have been infilled with up to 100 m of Devensian glacial till and glaciomarine/lacustrine deposits (Jackson *et al.*, 1995). The infilling deposits themselves contain generations of further incisions, likely occurring during the Devensian time period (Wood, 2022). Large-scale incisions within the site and wider area, infilled with Devensian material are recorded by the BGS (Jackson *et al.*, 1995) The ground model also identified ribbed moraines and flutes, corresponding with the high number of boulders identified within the units (Wood, 2022).
- 1.4.1.3 A variety of bedforms associated with seabed sediment mobility have been identified in the Morgan Array Area including ripples, megaripples, sandwaves and Barchan Dunes. The large dune structures appear to be moving eastward at a pace of between 2 m and 6 m per year (Wood, 2022).

Quaternary sequence

- 1.4.1.4 Sequences of Quaternary deposits have been recorded in the east Irish Sea comprising Holocene Sediments, deposits of the Surface Sand Formation; Weichselian Sediments, deposits of the Western Irish Sea Formation A (WIS-A), the Western Irish Sea Formation B (WIS-B), the Cardigan Bay Formation (CBF); Saalian to Eemian Sediments, deposits of the CBF; Saalian Sediments, deposits of the St George's Channel Formation (STG); Elsterian Sediments, deposits of the Caernarfon Bay Formation (FBF) and pre-Elsterian Sediments, deposits of the Bardsey Loom Formation (BLF).
- 1.4.1.5 Seismic data from the Morgan Generation Assets demonstrates that five Quaternary units overlay the bedrock, including both Pleistocene and Holocene deposits. Together these units average 5 to 10 m thick across the site. However, there are variations in thickness across the Morgan Array Area, with Quaternary deposits entirely absent in some areas, and extending to c.50 m in thickness in other areas (Wood, 2022). This broadly reflects the findings of BGS sampling and seismic data within the Morgan Array Area (British Geological Survey, 2014).
- 1.4.1.6 Holocene material varies greatly in thickness across the site, ranging from absent in places to 14 m thick in the southeast. The average thickness of these deposits across the site is c.0.5 m, though the Holocene sands are absent in many places, and thickest in the southeast of the site (Wood, 2022). The absence of Holocene sands may be due to activities in the area such as fishing, trawling and aggregate dredging as evidenced in the Historic Seascape Characterisation (paragraph 1.5.2.1).
- 1.4.1.7 The Quaternary sequence within the Morgan Generation Assets is shown in Table 1.6 and full details of the deposits can be found in Wood (2022). The units encountered in the evolving ground model were subject to a Stage 1 geoarchaeological assessment. The results of that assessment are presented in section 1.4.2 below.

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Table 1.6: Quaternary sequence.

Stratigraphy		Unit	Depositional Facies	Lithology	Age
Formation	Member				
Mobile Sands	Sediment Layer 1; Sediment Layer 2	Unit I	Marine	Loose to dense gravelly sand	Holocene
Western Irish Sea A (WIS-A)	Mudbelt	Unit II	Glaciomarine	Very low to low strength clay	Devensian
	Prograded Sands	Unit III	Glaciomarine	Dense to very dense sand and gravel	
	Chaotic	Unit IVa	Phase 4 Channels (distal)	Dense to very dense sand	
		Unit IVb	Phase 3 Channels (proximal)	Dense to very dense sand	
		Unit IVc	Ice-marginal Fan	Gravel and dense to very dense sand	
		Unit IVd	Sheet sands and gravels	Gravel and dense to very dense sand	
		Unit IVe	Phase 2 Channels	Dense to very dense sand	
		Unit IVf	Phase 1 Channels	Dense to very dense sand	
		Unit IVg	Phase 1 Channels	High to ultra-high strength gravelly sandy clay	
		Unit Va	Upper glacial lakes	Low to high strength sandy clay	
		Unit Vb		Low to high strength clay	
		Unit Vc		Medium dense to very dense sand	
	Unit Vd	Dense to very dense sand			
Unit Ve	Unknown – probably dense to very dense sand				
Unit VIa	Lower glacial lakes	High to high strength sandy clay			

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Stratigraphy		Unit	Depositional Facies	Lithology	Age
Formation	Member				
		Unit VIb		High to very high strength clay	
		Unit VIc		Dense to very dense sand	
Cardigan Bay	Upper Till	Unit VIIa	Sub-glacial till	Extremely to ultra-high gravelly clay	
		Unit VIIb		Extremely to ultra-high sandy gravelly clay	
		Unit VIIc		Weathered Sands and Clays over Carboniferous	
	Infill member	Unit VIII	Sub-glacial Tunnel Valley/Pro-Glacial Channel	Dense to very dense sand	Late Wolstonian/Early Ipswichian or Devensian

1.4.2 Stage 1 geoarchaeological investigation

1.4.2.1 In 2022, Fugro Marine Limited and Gardline were commissioned to undertake geotechnical site investigations within the Morgan Generation Assets, the Morgan and Morecambe Offshore Wind Farms: Transmission Assets Boundary and the Mona Offshore Wind Project and Transmission Assets Boundary.

1.4.2.2 The coring targeted seabed and sub-seabed features that had been identified through the geophysical survey campaigns. A complete marine geoarchaeological investigation should consist of four constituent stages, following the guidance provided by Wessex Archaeology for COWRIE (2011). Stage 1 evaluation was completed in 2023 by COARS (2023). Stage 1 evaluation consists of a geoarchaeological review of core logs comprising a desk-based assessment of geotechnical core logs and recommendations as to which cores should be subject to visual inspection and recording by a geoarchaeologist in Stage 2 of the geotechnical assessment to be carried out post-consent to inform the knowledge base. Three boreholes from the Morgan Generation Assets are recommended for Stage 2 geoarchaeological recording. These are:

- MRG-BH22-09: 27.00-29.80 m; 32.00-32.60 m; 34.00-34.80 m; 37.00-37.80 m; 44.00-44.80 m; 48.0 to 48.80 m; 68.50 to 68.80 m; 69.50-69.90 m (Unit VIIb)
- MRG-BH22-16: 5.00-6.00m; 6.00-7.00m; 8.00-8.50m; 8.50-9.00m; 9.50-10.00m; 11.00 to 12.00m; 12.00-12.70m (Unit Vb)
- MRG-BH22-19: 21.75-22.35 m; 25.75-26.45 m (Unit VIIa).

1.4.2.3 Stage 2 commences if the Stage 1 assessment identifies horizons of archaeological potential, such as those described above. This entails the detailed recording of the

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sediments within selected cores for a range of palaeoenvironmental indicators and dating material. The geotechnical cores need to be retained until the selection for archaeological recording has been made. Ideally one undisturbed half of each core is required for archaeological recording. The assessment programme will comprise the longitudinal splitting of each core section, the cleaning of half of each section and the detailed archaeological recording of each section, noting sediment colour, sediment type, sedimentary architecture and inclusions. A Stage 2 outline report will present the results of the archaeological recording and will indicate whether a Stage 3 laboratory assessment of the cores is warranted. The scope of further work will be agreed by the Applicant (via the RA) and the AC. If no further work is recommended a final (Stage 5) report will be produced by the geoarchaeological contractor. Full details of the stages of geotechnical assessment are provided in the Outline Offshore WSI and PAD (Document Reference J14).

1.4.2.4 Deep geotechnical investigations (up to 70 m below the seabed) were undertaken by Fugro resulting in samples taken from 46 locations (COARS, 2023). A shallow geotechnical investigation was undertaken by Gardline resulting in 66 locations selected for CPT and 66 for vibrocores (plus 28 repeats).

1.4.2.5 Based on the core descriptions, available photographs and the evolving ground model interpretation, cores were assessed in relation to their geoarchaeological potential. Within the Morgan Array Area, each of the ground model stratigraphic units was assessed but focused on Units IV, V and VII (see Table 1.6) as holding the greatest geoarchaeological potential. While samples from the Morgan Array Area indicate a series of terrestrial proglacial, possibly lacustrine and/or fluvial deposits, no palaeosols were encountered that might indicate submerged palaeolandscapes of human habitation. The units encountered during the Stage 1 investigation do, however, provide an opportunity to improve the chronology of the timing of Devensian glacial advance and retreat, and presence of a submerged landscape within the region (COARS, 2023).

1.4.3 Submerged prehistoric archaeology potential

1.4.3.1 This section characterises the potential for submerged prehistoric archaeology to be present within the Morgan marine archaeology study area. For example, deposits containing archaeological material (e.g., flint tools), or submerged landscapes. This section is informed by the results of the geophysical and geotechnical surveys and desk-based review of secondary sources cited within the text.

1.4.3.2 The prehistoric period of the UK covers from the earliest hominin occupation (potentially as early as c. 970,000 Before Present (BP)) to the end of the Iron Age and the Roman invasion of Britain in Anno Domini (AD) 43. The coastline of the UK underwent dramatic changes during this time, and areas of the seabed that are now fully submerged would have been exposed allowing the opportunity for hominins to exploit and inhabit the landscape. Glacial events including the Anglian (480,000 to 430,000 BP), the Wolstonian (350,000 to 132,000 BP) and the Devensian (122,000 to 10,000 BP) and intervening periods of marine transgression have affected the coastline of the UK and therefore the archaeological potential of these areas.

1.4.3.3 Prehistoric archaeological potential is determined with reference to evidence for human activity in the UK during each period, and the contemporary environment within the site. Depositional environment and post-depositional factors are also key to understanding potential, and as such geological deposits present within the site form an important consideration in understanding archaeological, palaeoenvironmental and

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palaeolandscape potential. Geological periods referred to in this section are defined by the date ranges presented in Table 1.7.

Table 1.7: Geological periods and archaeological associations.

Period	Date Range	Notes
Holocene	10,000 BP to Present Day	Mesolithic, Neolithic, Bronze Age, Iron Age, Roman, Medieval, Post Medieval and Modern periods. The Holocene is the current time period within the larger geological time scale known as the Quaternary Period.
Devensian from Post Late Glacial Maximum to Late Glacial Interstadial	18,000 BP to 10,000 BP	Coincides with the Late Upper Palaeolithic and the early Mesolithic.
Devensian up to Late Glacial Maximum	c. 73,000 to 18,000 BP	Arrival in the UK of Late Middle Palaeolithic Neanderthals, who were followed approximately 31,000 BP by Early Upper Palaeolithic, anatomically modern humans (<i>Homo sapiens</i>).
Ipswichian (interglacial)	c. 130,000 to c. 115,000 BP	Last interglacial in the UK. Overlaps with the Late Middle Palaeolithic.
Wolstonian	c. 374,000 to c. 130,000 BP	Predominantly Pleistocene glaciation. Incorporates the earliest period of the Late Middle Palaeolithic.

Late middle palaeolithic (186,000 to 45,000 BP 184,000 to 43,000 Before Christ (BC))

- 1.4.3.4 Deposits representing the final glacial stage of the Wolstonian glaciation are present within the Morgan marine archaeology study area, indicating that the area was subglacial during this period and therefore uninhabitable by humans.
- 1.4.3.5 While most deposits within the Morgan marine archaeology study area are thought to relate to the Devensian and Holocene periods, Unit V may relate to deposits that are associated with the Cardigan Bay Formation, laid down during the transition into the Ipswichian Interglacial. The Stage 1 geoarchaeological assessment observed a complex range of depositional environments in Unit V deposits, supporting the interpretation of the presence of a possible glacial lake (COARS, 2023).
- 1.4.3.6 Improvements in climate during the Ipswichian Interglacial may have allowed for environments which were more conducive to human activity. However, no such activity or deposits associated with human activity have been identified within the UK dating to this period (Marshall *et al.*, 2020). The analysis of seismic data from within the Morgan Array Area and evidence from the wider area therefore suggests that deposits representing environments favourable for human occupation dating to the Late Middle Palaeolithic are not likely to be present within the Morgan marine archaeology study area (Jackson *et al.*, 1995; Mellett *et al.*, 2015; Wood, 2022).

Upper palaeolithic (45,000 to 10,000 BP 43,000 to 8000 BC)

- 1.4.3.7 The Devensian glaciation coincides with the Upper Palaeolithic and follows the Ipswichian Interglacial, which was the last period of glaciation to affect the UK. Deglaciation may have commenced from c. 20,000 BP with the Morgan marine archaeology study area being ice free by 18,000 BP, although the retreating ice sheet may have been in close proximity at the time near the Isle of Man (c. 40 km northwest). Paleoenvironmental potential has been demonstrated through the recovery of floral and faunal remains within Unit III (Jackson *et al.*, 1995). However, the proximity of the Morgan marine archaeology study area to areas of glaciation would suggest a very low potential for human occupation or activity, and therefore the presence of submerged prehistoric archaeological material dating to this period.
- 1.4.3.8 Sea level and landscape changes within the Morgan marine archaeology study area and its surrounding environment during the Upper Palaeolithic are not conclusively understood. Some studies suggest that the Liverpool Bay area would have been an entirely marine environment during this time, whilst other evidence indicates that it would have been a partially terrestrial environment dominated by fluvial systems and related floodplains (Brooks *et al.*, 2011; Jackson *et al.*, 1995; Mellett *et al.*, 2015; Fitch *et al.*, 2011). The West Coast Palaeolandscapes Study (WCPS) supports the latter in finding that areas of Liverpool Bay would have been terrestrial following the Last Glacial Maximum and therefore capable of supporting human habitation.
- 1.4.3.9 The Stage 1 geoarchaeological assessment of Unit V in the Morgan Array Area indicates a complex range of depositional environments during the period support the presence of a water body being present, possibly a glacial lake as proposed by Wood (2022). Unit IV found across the Morgan Array Area indicates it comprises seven sub-units, all of which are interpreted to represent the retreat of the Irish Sea Ice Stream (ISIS). The conclusion of the geoarchaeological assessment of the depositional environment of Unit IV is a distal glaciofluvial system crossing an outwash plain, with sub-units representing glaciofluvial channelling (COARS, 2023). The date around which the final submergence of the area took place is also not conclusive, with some studies (Brooks *et al.*, 2011), (see Figure 1.2) indicating submergence of the Morgan Array Area c. 13,000 BP and others arguing for c. 6000 to 7000 BP (Fitch *et al.*, 2011).
- 1.4.3.10 Figure 1.2 (Brooks *et al.*, 2011; EMODnet Geology, 2019) shows that at 16,000 BP there may have been limited areas of intertidal or terrestrial landscape within the Morgan marine archaeology study area, with final submergence occurring c.13,000 BP. However, these are extremely limited and represent a very low potential for the presence or survival of archaeological material. Even if the theory that the Morgan marine archaeology study area was a partially terrestrial environment during the Upper Palaeolithic is accepted, it would likely not have been a favourable environment for human exploitation. Permafrost would have been present in the area, limiting the growth of vegetation and therefore the availability of resources for human exploitation.

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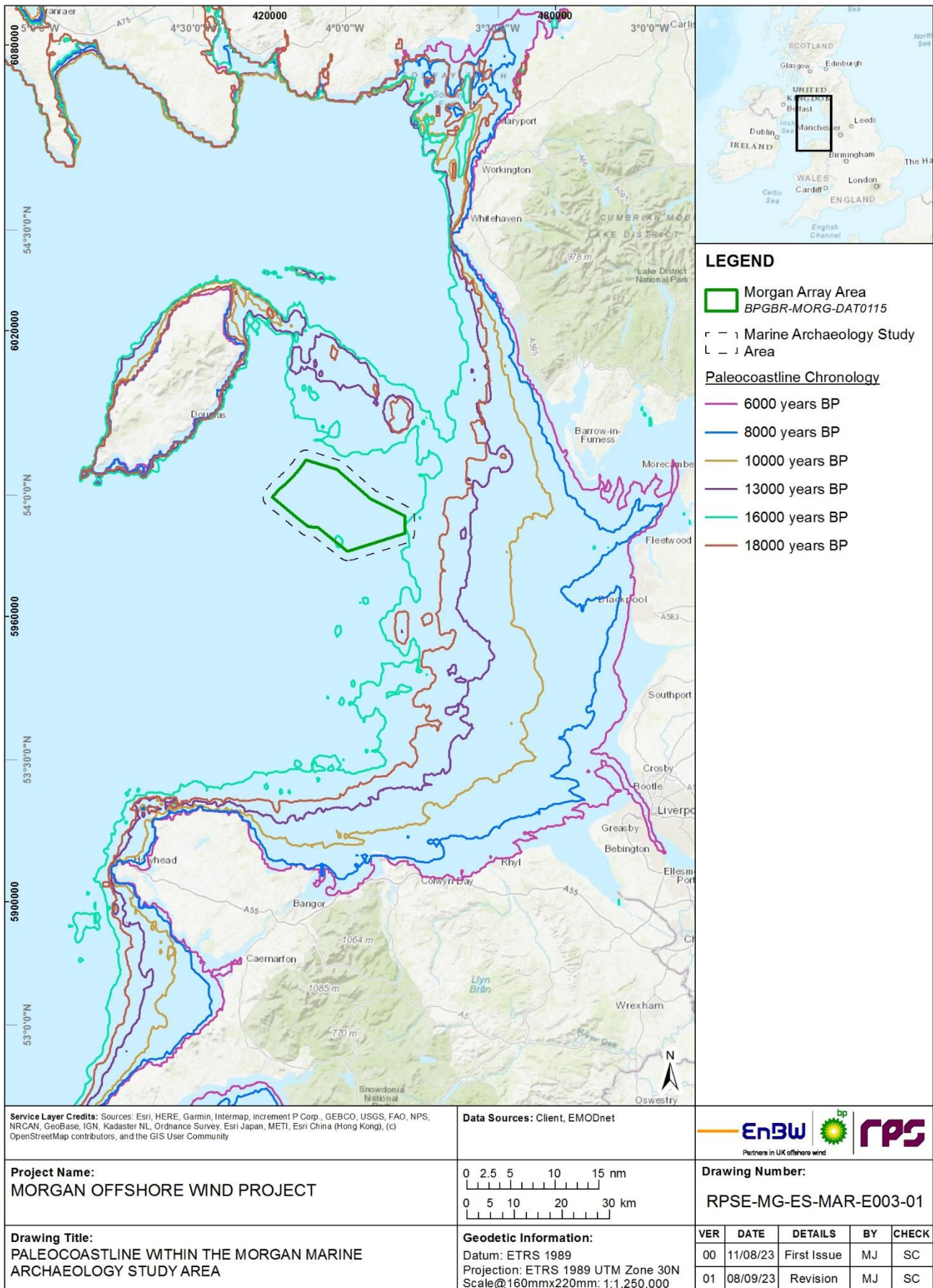


Figure 1.2: Palaeocoastlines within the Morgan marine archaeology study area (EMODnet Geology, 2019).

Mesolithic (10,000 to 6000 BP 8000 to 4000 BC)

- 1.4.3.11 The debated chronology for the submergence of the Morgan marine archaeology study area is significant for this period as if the earlier date of 13,000 BP is accepted then the area would have been fully submerged by the advent of the Mesolithic and therefore incapable of sustaining human occupation. However, if the later date of 7000 to 6000 BP is accepted then the partially terrestrial environment may well have been inhabited by humans and represent the potential for the survival of archaeological material.
- 1.4.3.12 Improvements in climate conditions at this time would have brought about environments in which vegetation could thrive. Landscape modelling undertaken by the WCPS suggests that the Morgan marine archaeology study area would have been partially intertidal during the Mesolithic (Figure 1.3). The intertidal represents an environment that is rich in available resources for human exploitation, access to the sea would provide humans a food source in the form of fish and shellfish. The intertidal zone is also an environment which encourages the growth of vegetation that could be utilised for food and resources. The landscape would have been one of low energy river systems, kettle holes and water-filled incisions, these features may have also been focal points of prehistoric activity and kettle holes have the potential for Mesolithic and palaeoenvironmental assemblages as evidenced at other kettle hole sites in Killerby, North Yorkshire and Slotseng, Denmark (Hunter and Waddington 2018; Noe-Nygaard *et al.*, 2007). The WCPS indicates that a kettle hole lake may be situated to the northeast of Morgan Array Area. Further evidence on the timing of the marine transgression is required in order to fully understand the submerged prehistoric potential of the Morgan marine archaeology study area.
- 1.4.3.13 The Holocene Mobile Sands Formation have been correlated to Unit I, as shown in Table 1.6, and represent the final marine transgression of the Irish Sea. Two Sediment Layers (SLs) were identified (MSDS Marine, 2022). The Sediment Layer 2 (SL2) member is interpreted as intertidal to marine. Peat within the SL2 member was identified in a BGS borehole c.65 km south of the site (70/07) which is believed to represent a reed swamp dating to 9200 BP (Jackson *et al.*, 1995 and Mellett *et al.*, 2015). These indicate some potential for both paleoenvironmental and archaeological remains to be present. A series of proglacial, possibly lacustrine/fluvial deposits have been identified within several of the Units identified within the ground model (COARS, 2023). These offer the potential to be dated, and therefore improve the chronology of the timing of Devensian glacial advance and retreat. Stage 2 geotechnical analysis will also provide information on the presence of a submerged palaeolandscape, within the region, as well as provide palaeoenvironmental information. This will help improve the classification of these features and provide additional refinement to the evolving ground models.
- 1.4.3.14 The boreholes held no evidence to suggest human occupation of the area and therefore any potential for the survival of prehistoric archaeological material. However, a series of sub-glacial and pro-glacial landscape features and deposits were identified. These have the potential to provide evidence that will lead to a better understanding of the late Devensian dynamics of the Irish Sea Ice Stream, including the timing of ice retreat within the east Irish Sea region.
- 1.4.3.15 Following the Stage 1 geoarchaeological assessment, five boreholes have been recommended for Stage 2 geoarchaeological recording. The results of which will continue to be disseminated post-application to inform the knowledge base.

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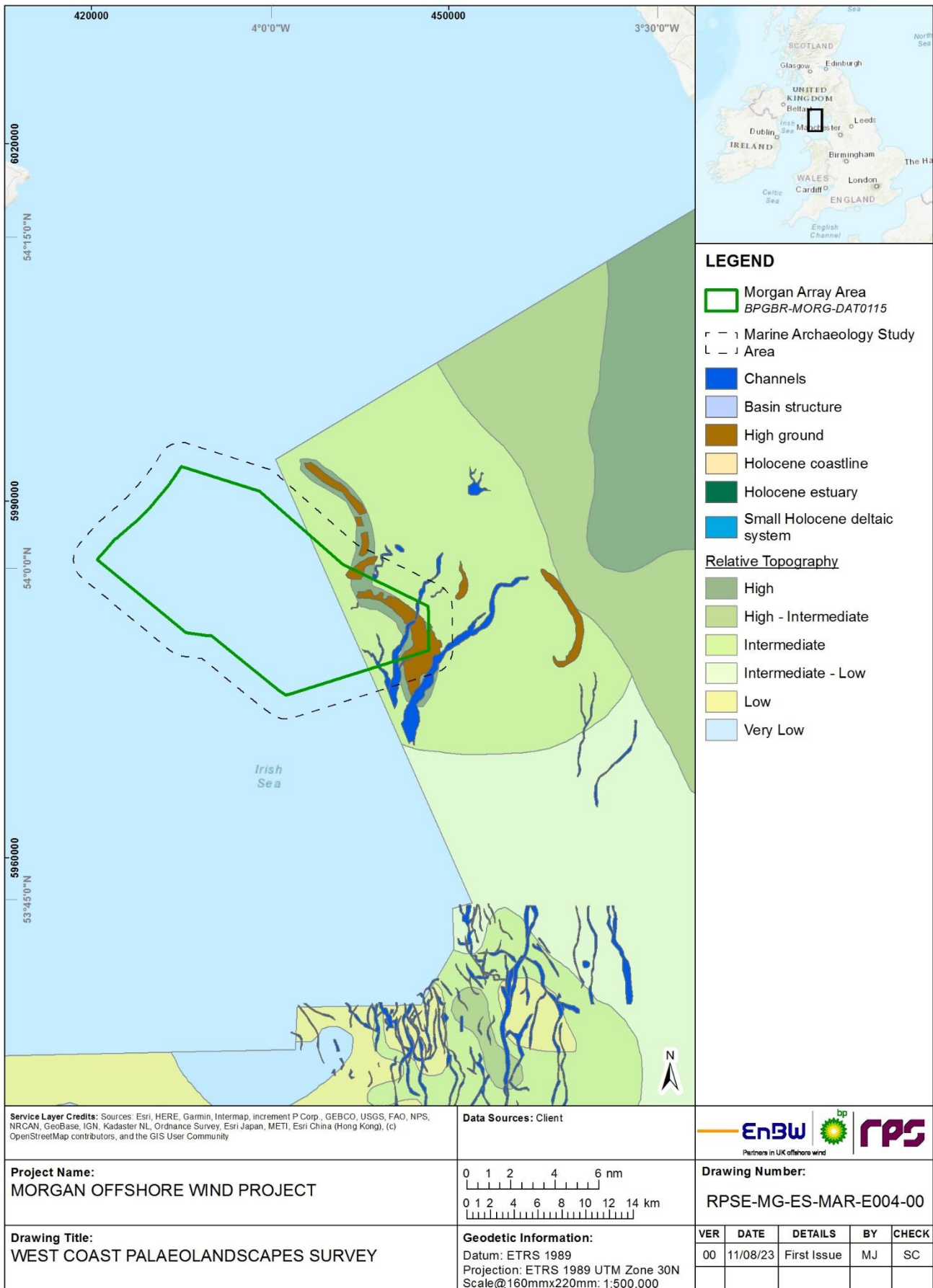


Figure 1.3: West Coast Palaeolandscape Study reconstruction of the Morgan marine archaeology study area.

1.5 Marine archaeological assessment: maritime and aviation archaeology

1.5.1 Maritime archaeological potential

- 1.5.1.1 The maritime archaeology of the UK is the product of a complex interplay of constantly evolving coastal and marine activities, international links and patterns of shipping, and sea use since the earliest human occupation of the UK during the late Palaeolithic to modern periods. This section reviews the potential presence of maritime archaeology within the Morgan marine archaeology study area associated with these maritime activities, such as ship and aviation wrecks and associated material. Military remains are also covered within the scope of maritime archaeology considered in this section.
- 1.5.1.2 Through this section, the maritime archaeological record of the Morgan marine archaeology study area has been considered chronologically for the following broad temporal phases as described in Table 1.8. However, as the survival of maritime archaeological evidence during the Palaeolithic and Mesolithic is extremely rare, these chronological periods have been considered under the term Early Prehistoric.
- 1.5.1.3 Prior to the advent of the Lloyds of London list of shipping casualties in 1751, there was no official record of ship losses (Wessex Archaeology, 2007) therefore records of known wreck sites and losses in UK waters are biased towards the Post-Medieval and Modern periods and therefore the precise locations of most wrecks pre-dating these periods in UK waters are not known. The majority of known and recorded wreck sites lie relatively close to the coast. The proximity of many historical sailing routes to the coast and the natural hazards of the east Irish Sea can be expected to have been a determining factor in many maritime casualties in the past (Wessex Archaeology, 2008).
- 1.5.1.4 Archaeology is considered in terms of periods that represent timeframes which are defined and categorised by the culture of the people of the time, notable changes in culture and activities are indicated by changes in chronological periods. Dates are referred to as Before Christ (BC), or anno domini (AD).
- 1.5.1.5 The chronological periods and their corresponding date ranges that are considered within the report are provided in Table 1.8.

Table 1.8: Overview of British archaeological chronology.

Period	Date Range
Palaeolithic	c. 900,000 to 12,000 BC
Mesolithic	12,000 to 4000 BC
Neolithic	4000 to 2500 BC
Bronze Age	2500 to 800 BC
Iron Age	800 BC to AD 43
Romano-British	AD 43 to 410
Early Medieval	AD 410 to 1066
Medieval	AD 1066 to 1500
Post-medieval	AD 1500 to 1800
19th century	AD 1800 to 1899

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Period	Date Range
Modern	AD 1900 to present day

Early prehistory (Palaeolithic to Mesolithic)

- 1.5.1.6 There is currently no evidence in the UK for maritime archaeological remains pre-dating the start of the Holocene. However, there are examples from elsewhere in the world which suggest that primitive watercraft were in use by the Middle Palaeolithic period, such as the suggestion that the colonization of Australia approximately 40,000 BP involved island-hopping in or on primitive watercraft (Lourandos, 1997).
- 1.5.1.7 During the Late Upper Palaeolithic (approximately 12,000 BC), it is possible that simple watercraft such as log boats or rafts were used for coastal journeys and fishing within the British Isles (Wessex Archaeology, 2007b and Dunkley, 2016), however no evidence of Palaeolithic sea-faring craft is currently known.
- 1.5.1.8 The first archaeological evidence for the use of watercraft in the UK dates to the Mesolithic and is from Star Carr in Yorkshire where fragments of a wooden oar have been identified (Van de Noort, 2011 and Wessex Archaeology, 2007b). A burial in a partially burnt dugout canoe was found in St. Albans, Hertfordshire in 1988 dating to the late Mesolithic to early Neolithic (Dunkley, 2016). Finds in Germany and Denmark suggest that logboats were used for coastal journeys.
- 1.5.1.9 Watercraft may have been used in the rivers and estuaries during the Mesolithic for coastal journeys, fishing expeditions, and possibly longer journeys in favourable weather. The evidence of the exploitation of the coastal resource suggests the possible use of watercraft during this period. They are likely to have become increasingly important to the Mesolithic inhabitants with rising sea levels. However due to the paucity of evidence and fluvial activity across the Morgan marine archaeology study area, the potential for the survival of any archaeology associated with the maritime environment from the Palaeolithic and Mesolithic periods is considered low.

Neolithic and Bronze Age

- 1.5.1.10 No evidence of Neolithic or Bronze Age maritime activity has been recorded within the Morgan marine archaeology study area.
- 1.5.1.11 Direct archaeological evidence for the exploitation of the marine environment and maritime activity from the Neolithic is rare and limited to logboat finds (Johnstone, 1980; Wilkinson and Murphy, 1995; Bradley *et al.*, 1997) and shell middens containing the faunal remains of deep sea fish (Ellmers, 1996). Little is known of watercraft or vessels from this period and archaeological evidence of them is so rare that all examples of craft would be considered of high value, however the potential for these discoveries within the Morgan marine archaeology study area is low.
- 1.5.1.12 The Bronze Age (approximately 2200 to 700 BC) was a period of technological innovation and of expansion of trade and exchange networks, facilitated by the introduction of new forms of boats both for ocean and coastal/riverine trade. Clear advances occurred in maritime technology during this period and an increasingly substantial maritime archaeological record allows a less speculative understanding of maritime culture than for earlier periods.
- 1.5.1.13 Evidence of Bronze Age maritime activity has been recorded throughout England in the discovery of a number of inland watercraft and sea faring vessels. Five sewn plank

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boats have been discovered at Ferriby in North Yorkshire known collectively as the Ferriby Boats. The Dover Boat is considered to be the world's oldest sea-faring boat dating to c.3500 BC which was excavated in 1992 during the construction of the A20 road link between Folkstone and Dover. A further eight Bronze Age boats dating to 3000 BC were discovered on the outskirts of Peterborough in 2013 (The Guardian, 2013). No such examples have been recorded in the vicinity of the Morgan marine archaeology study area; however it is possible that similar crafts would have been utilised to traverse the area. The potential for the discovery of maritime archaeology from the Bronze Age is considered to be low.

Iron Age and Romano-British

- 1.5.1.14 Evidence of Iron Age maritime activity has been discovered in the form of Romano-Celtic boats which are examples of a new form of ship construction that was emerging in northwest Europe at the time. In 1962 the remains of a seagoing trading vessel named the Blackfriars boat were excavated in London (Marsden, 1994). Slightly closer to the Morgan marine archaeology study area, a smaller example of a Romano-Celtic boat named the Barlands Farm boat was discovered in the Severn estuary and is considered to have also been capable of coastal and sea journeys (Lawer and Nayling, 1993).
- 1.5.1.15 The Poole logboat is one of the largest logboats to have been discovered in Britain and radiocarbon dating has dated it to c.295 BC, making it an excellent example of Iron Age watercraft, which is currently located at the Poole Museum. The discovery of boats such as these indicates that maritime transport was an important part of Iron Age life, however the organic construction materials used mean that the potential for the survival of Iron Age maritime archaeology within the Morgan marine archaeology study area is low.
- 1.5.1.16 The County Hall ship, discovered in London and dendrochronologically dated to the 3rd century AD is an example of a boat demonstrating a typically Mediterranean construction method, however the dendrochronological evidence shows that it was constructed in Britain during the Roman period (Marsden, 1974). The ship was carvel built, with the planks being held together by mortice and tenon joints. Roman maritime evidence has also been discovered in Wales, in Porth Felen, Gwynedd a lead anchor stock was recovered (Boon, 1977).
- 1.5.1.17 The Roman occupation of Britain was by necessity a maritime endeavour, which would have required continuous transportation of resources and people to the military and civilian sites established by the Romans. Sites such as these can be found along Liverpool Bay and therefore it stands to reason that there would have been substantial Roman maritime traffic in this area. However, as stated above, the use of organic construction materials means that the potential for the survival of maritime archaeology material from this period is low to moderate with the exception of areas where peat survives, as peat creates an anaerobic environment which facilitates the preservation of organic material.

Early medieval and medieval

- 1.5.1.18 The early medieval period marks a change in ship construction techniques evidenced within the archaeological record and coinciding with the end of the Roman occupation in the 5th century AD and an increasing Anglo-Saxon presence in the form of Norse and Danish Vikings. Influences on ship construction came from Scandinavian connections and with them the increased emphasis on clinker construction. Several

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examples have been discovered in Britain, including the Snape boat grave (5th to 6th century AD), the famous Sutton Hoo (7th century AD) and Graveney boat (8th to 9th century AD).

- 1.5.1.19 The Snape boat grave derives its name from its location of discovery at Snape Common, near Aldeburgh in East Anglia. It is clinker-built and about 15 m long (Bruce and Mitford, 1952).
- 1.5.1.20 The Sutton Hoo boat burial is arguably one of Britain's most important archaeological discoveries. Found near Woodbridge, Suffolk and dating to the 7th century AD, it is a clinker built vessel and was over 27 m long. The Sutton Hoo boat burial formed part of a horde of grave goods, the study of which radically re-evaluated ideas on Anglo-Saxon technology. The Graveney boat discovered in Kent is an 8th to 9th century AD clinker built vessel of about 14 m long. The Graveney boat is particularly unique in that it is an example of a trading vessel as opposed to the high-status warships of the previous examples (Fenwick, 1978). All of these boats would have been capable of sea-voyages and indicate an increase in long-distance trade and exploration during this time. A trend that continues to increase during the medieval period.
- 1.5.1.21 With the medieval period came a boom in maritime trade across Europe and further afield with the establishment of several trading confederations such as the Hanseatic league at this time. Trade expanded across the Irish Sea at this time also, with Dublin becoming an increasingly important commercial port, contributing to the maritime transportation of goods through the Irish Sea.
- 1.5.1.22 Increased demand for goods meant that ship construction advanced rapidly during this period to accommodate larger cargoes. Types of boats dating from early medieval and medieval include larger clinker-built merchant vessels called keels, cogs and possibly reverse clinker-built vessels termed hulks (Friel, 2003). Examples of trading vessels from this period include the Magor Pill, a 12th century clinker built vessel with a cargo of iron ore found on the banks of the Severn Estuary near Newport, in South Wales and the protected wreck located at Pwll Fanog in the Menai Strait, Gwynedd. The remains of a clinker built boat with a cargo of slate which was found by divers in 1976, with subsequent research giving a probable fourteenth or fifteenth century date for the vessel (Fenwick and Gale, 1998).
- 1.5.1.23 The rapid technological advances in ship construction during the medieval period can also be attributed to increased military campaigns also. This is particularly true in the Irish Sea where the campaigns of Edward I and Edward II against the Scots in the fourteenth century were supplied with men and resources from Ireland. Due to the large increase of maritime traffic that would have occurred in the Irish Sea during the early medieval and medieval period, the potential for the discovery of archaeological remains dating from this period is considered to be moderate.

Post medieval and modern

- 1.5.1.24 The post-medieval and modern periods present the greatest potential for unrecorded archaeology to be discovered. The increasing incorporation of metal structural elements into vessel designs during this period means that wrecks for the 19th and early 20th centuries are also often more visible on the seabed than their wooden predecessors. They are visible to bathymetric and geophysical survey, and also generate strong magnetic anomalies, and this greater visibility is reflected in the increased number of known wrecks (i.e. those that have been located on the seabed) in contrast to earlier periods.

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- 1.5.1.25 International trade with ports around the Irish Sea becomes increasingly important in the post medieval period. An example of an international trade ship that was discovered in the Irish sea is the Tal-y-Bront or Bronze Bell wreck which is thought to be a Genoese wreck depicted on an Admiralty chart from the eighteenth century close to Sarn Badrig reef. The wreck was discovered in Cardigan Bay, south of the Morgan marine archaeology study area with a cargo of uncut blocks of Italian Carrera marble. The wreck site has undergone several archaeological investigations and was designated in 1978 (Wessex Archaeology, 2005).
- 1.5.1.26 Another designated wreck from the post medieval period is located closer to the south of the Morgan marine archaeology study area. The wreck of the Royal yacht *Mary* sank when it struck the Skerries off Anglesey in 1675. The *Mary* was built by the Dutch East India Company (VOC), purchased by the City of Amsterdam, and given to Charles II upon his restoration to the throne. It was used for royal duties for a year and was then employed as a transport vessel for officials between Dublin and Chester. The wreck was discovered in 1971 by divers and was designated as a protected wreck in 1974 under the Protection of Wrecks Act 1973.
- 1.5.1.27 Trade between England and Ireland increased during the 16th century as England produced larger quantities of coal, a resource which was scarce in Ireland. This growth in trade led to the establishment and expansion of ports such as Mayport on the Solway Firth to the north of the Morgan marine archaeology study area.
- 1.5.1.28 During the 18th century there was also increased military activity from France, who planned a series of, ultimately unsuccessful, invasions of Ireland and Wales in 1759, 1796 and 1797. This led to a substantial increase of traffic in the Irish Sea, not just from the French but also in the form of British ships to stave off the threat of invasion and protect shipping and trade interests in the area.
- 1.5.1.29 From the 18th century onwards, records were kept of ship losses, with records becoming more detailed from the 19th century. Rapid industrialisation in the 18th and 19th centuries revolutionised shipbuilding, introducing technological innovation that precipitated fundamental changes in maritime technology. By the end of the 19th century with the advent of the steam engine, the introduction of iron hulls and the development of the screw propeller had wrought major transformations on ships and shipping (Lambert, 2001). Although steam and steel came to dominate shipping during the 19th century, there remained a strong local core of maritime activity around much of the coast of the UK which retained the more traditional, often wooden vessel types.
- 1.5.1.30 The potential for the discovery of unknown maritime archaeology from the post medieval and modern periods within the Morgan marine archaeology study area is high.

Modern military remains

- 1.5.1.31 The maritime archaeological record of the 20th century until the present day is dominated by remains associated with the two World Wars. Warships, submarines and U-boats along with cargo vessels, personnel transport vessels and aircraft, comprise the losses during this period.
- 1.5.1.32 World War I (WWI) saw the advent of the use of submarines in European waters, following their widespread usage in the American Civil War. Shipping activity around Britain was targeted by enemy submarines and a great number of vessels were lost this way.

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- 1.5.1.33 During both World Wars submarine activity was extensive in the Irish Sea. There are a total of seven U-boat wrecks from World War II (WWII) located in the Irish Sea. There are a further two Allied losses designated under the Protection of Military Remains Act 1986 present within the Irish Sea, HMS H5 and SS Rutherglen were both lost in a collision with each other off Anglesey. Closest to the Morgan marine archaeology study area, the HMS H5 was lost off Anglesey after being rammed by a British cargo ship the SS Rutherglen during U-boat manoeuvres. The submarine was mistaken for a U-boat, and all hands were lost.
- 1.5.1.34 Advances in maritime technology during WWII meant an increase in naval offenses, this means that there was a substantial increase in recorded losses from this period, and therefore the potential for the discovery of unknown maritime archaeology from both World Wars is considered to be high.

1.5.2 Historic seascape character

- 1.5.2.1 In 2009 English Heritage (now Historic England) commissioned an HSC. An HSC follows the same principles as Historic Landscape Characterisation, and is designed to complement marine and coastal planning, this is with particular regard to the statutory responsibilities of Historic England.
- 1.5.2.2 The assessment of HSC furthers the principles of the European Landscape Convention by characterising 'seascape' as a subset of 'landscape' which is defined as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe, 2000). HSC assessment is the identification and interpretation of the historic dimension of the present day coastal and marine environment (Natural England, 2012).
- 1.5.2.3 The Irish Sea HSC (Turner and Newman, 2011) covers coastline and territorial waters of the northwest region of England, with the adjacent UK Controlled Waters. The boundaries are defined by the national border with Wales in the south, the border between UK and Isle of Man to the west, and the national border with Scotland to the north. Therefore, HSC is available for most of the Morgan marine archaeology study area, it can be reasonably assumed that the areas of the Morgan marine archaeology study area that are within Welsh territorial waters can be characterised similarly. The utilisation and exploitation of the east Irish sea has been summarised in the marine archaeological baseline (section 1.5.1).

The HSC method characterises historic trends and process that have shaped the marine archaeological environment to provide information for the sustainable management of English marine and coastal environments. The marine environment is considered in four 'levels': the sea surface, the water column, the sea floor and the sub-sea floor. The results are available in GIS compatible downloads from the ADS which allows key characteristics within the Morgan archaeology study area to be identified. These are presented in Table 1.9.

Table 1.9: HSC within the Morgan marine archaeology study area.

Character Area	Character type within the Morgan marine archaeology study area	Date
Conflated	Bottom trawling	Modern (AD 1900 to Present)
	Fishing ground (concentration of bottom trawling and shellfish dredging)	Modern (AD 1900 to Present)
	Maritime debris	Modern (AD 1900 to Present)

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Character Area	Character type within the Morgan marine archaeology study area	Date
	Navigation routes	Modern (AD 1900 to Present)
	Potting	Modern (AD 1900 to Present)
	Shellfish dredging	Modern (AD 1900 to Present)
	Submarine power cable	Modern (AD 1900 to Present)
	Submarine telecommunications cable	Modern (AD 1900 to Present)
	Coarse sediment plains	Unknown
	Fine sediment plains	Unknown
Sea Surface	Bottom trawling	Modern (AD 1900 to Present)
	Fishing ground (concentration of bottom trawling, shellfish dredging)	Modern (AD 1900 to Present)
	Maritime debris	Modern (AD 1900 to Present)
	Navigation routes	Modern (AD 1900 to Present)
	Potting	Modern (AD 1900 to Present)
	Shellfish dredging	Modern (AD 1900 to Present)
	Submarine power cable	Modern (AD 1900 to Present)
	Submarine telecommunications cable	Modern (AD 1900 to Present)
	Coarse sediment plains	Unknown
	Fine sediment plains	Unknown
Water Column	Bottom trawling	Modern (AD 1900 to Present)
	Fishing ground (concentration of bottom trawling, shellfish dredging)	Modern (AD 1900 to Present)
	Maritime debris	Modern (AD 1900 to Present)
	Navigation routes	Modern (AD 1900 to Present)
	Potting	Modern (AD 1900 to Present)
	Shellfish dredging	Modern (AD 1900 to Present)
	Submarine power cable	Modern (AD 1900 to Present)
	Submarine telecommunications cable	Modern (AD 1900 to Present)
	Coarse sediment plains	Unknown
	Fine sediment plains	Unknown
Sea Floor	Bottom trawling	Modern (AD 1900 to Present)
	Fishing ground (concentration of bottom trawling, shellfish dredging)	Modern (AD 1900 to Present)
	Maritime debris	Modern (AD 1900 to Present)
	Navigation routes	Modern (AD 1900 to Present)
	Potting	Modern (AD 1900 to Present)

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Character Area	Character type within the Morgan marine archaeology study area	Date
	Shellfish dredging	Modern (AD 1900 to Present)
	Submarine power cable	Modern (AD 1900 to Present)
	Submarine telecommunications cable	Modern (AD 1900 to Present)
	Coarse sediment plains	Unknown
	Fine sediment plains	Unknown
Sub-Sea Floor	Submarine power cable	Modern (AD 1900 to Present)
	Submarine telecommunications cable	Modern (AD 1900 to Present)
	Coarse sediment plains	Unknown
	Fine sediment plains	Unknown

1.5.2.4 The sub-character types can be broken down into the following categories:

- Fishing activities such as bottom trawling, potting, and shellfish dredging in the modern period
- Modern installations and activities such as submarine cables
- Modern maritime debris
- Modern navigation routes
- Seabed types and characteristics of fine and coarse sediment plains.

1.5.2.5 The historical cultural processes which have shaped the character of the Morgan marine archaeology study area are predominantly related to fishing and navigation activity, suggesting a high presence of maritime traffic in the area and therefore a high potential for maritime archaeology.

1.5.3 Navigation hazards

1.5.3.1 In 2009 Bournemouth University (commissioned by English Heritage, now Historic England) undertook the project Mapping Navigational Hazards as Areas of Maritime Archaeological Potential (Bournemouth University, 2009). Historical records of shipwreck data were analysed in combination with areas of seabed with where sediments are conducive to the preservation of archaeological material, frequency of hydrographic surveys and high-traffic marine environments, such as around ports and harbours. These combined factors were considered Areas of Maritime Archaeological Potential (AMAPs).

1.5.3.2 Liverpool Bay, Morecambe Bay and their approaches have been considered AMAPs due to historically high maritime traffic and an offshore sandy seabed. Therefore, there is a high potential for archaeological wreck sites within and close to the Morgan marine archaeology study area.

1.5.4 Maritime recorded losses

1.5.4.1 Only one recorded loss has been identified within the NMRW data for the Morgan marine archaeology study area. Record number 240004 is the record of the *Sunrise*, a 24' wooden sailing smack (a type of traditional fishing boat), which was captured by

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a German submarine and scuttled. All four crew were taken prisoner, with three survivors being put on the ship's boat where they made their way to Whitehaven. No further details are given. The record states that no archaeological remains are confirmed at the location. The wreck has not been identified during surveys, nor in the geophysical data, but may correspond with UKHO 5477, a record of a possible wreck site situated outside of the Morgan marine archaeology study area.

- 1.5.4.2 Recorded losses represent maritime and aviation losses that are known to have occurred in the vicinity but to which no specific location can be attributed. Recorded losses are often attributed to a geographic, hydrographic or other point of reference, making the positional data of these records unreliable. However, they do provide information on the historical marine traffic of the general region and therefore the archaeological potential. Recorded losses may correspond to unknown anomalies identified by the geophysical survey, or they may be positioned outside the Morgan marine archaeology study area.

Aviation archaeology potential

- 1.5.4.3 Thousands of military and civilian aircraft casualties have occurred in UK waters since the advent of powered flight in the early 20th century. The bulk of these are casualties of WWII and most are concentrated off the south and southeast coasts of England. However, there is evidence for substantial numbers of aircraft casualties in the east Irish Sea (Wessex Archaeology, 2008).

- 1.5.4.4 Whilst the aviation archaeology record is potentially very large, the ephemeral nature of aircraft wrecks ensures that many sites remain unknown and unrecorded. In addition, although records of aircraft losses at sea are extensive, they are seldom tied to an accurate position, which further complicates any assessment of the likely presence of aircraft wreckage on any particular area of the seabed. Therefore, the potential for aircraft dating to WWII to survive in the Morgan marine archaeology study area is considered to be low.

- 1.5.4.5 Since WWII, despite the volume of both military and civilian air traffic, there have been few aviation losses off the west coast of England and north Wales, in the vicinity of the Morgan marine archaeology study area. The potential for post-war aircraft remains to be discovered within the Morgan marine archaeology study area for the Transmission Assets is therefore considered to be low. Civilian aircraft wrecks are not subject to protection under the terms of the Protection of Military Remains Act 1986.

1.5.5 Aviation archaeology

- 1.5.5.1 One record relating to a potential aircraft crash site was returned from the UKHO (5418) and NRHE (909495) data within the Morgan marine archaeology study area and considered 'live' by the UKHO (Figure 1.4). This relates to aircraft wreckage reported by divers in 1991. No wreck, or material of anthropogenic origin was identified within the geophysical data at the stated position. The record may require further investigation as if a crashed military aircraft is present and identified as being British, then it will be automatically afforded 'protected place' status under the Protection of Military Remains Act 1986. As a precautionary approach a TAEZ of 100 m from the UKHO coordinates is established to ensure the protection of any aviation material.

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1.5.6 Overview of potential

1.5.6.1 An overview of the marine archaeological potential within the Morgan marine archaeology study area is presented in Table 1.10.

Table 1.10: Overview of marine archaeological potential.

Receptor	Potential	Value
Submerged prehistoric archaeology	Low	Local/Regional/National
Paleoenvironmental evidence	Low	Local/Regional/National
Early prehistoric maritime evidence	Low	National
Bronze Age maritime evidence	Low	National
Iron Age and Roman maritime evidence	Low to Moderate	National
Early medieval and medieval maritime evidence	Moderate	Regional/National
Post medieval and modern maritime evidence	High	Local/Regional/National
Modern military remains	High	Local/Regional/National

1.5.7 Designated, known and recorded wrecks

1.5.7.1 No designated sites have been identified within the datasets for the Morgan marine archaeology study area.

1.5.7.2 Within the UKHO data there are 11 entries that relate to wreck sites within the Morgan marine archaeology study area and one that corresponds to the aircraft discussed in section 1.5.5. Of these, six are considered 'live'; the further five are all listed as 'dead' indicating that no remains of these wrecks are currently visible on the seabed. This has been confirmed by the geophysical survey and the wrecks are not considered to survive at these locations. Full details of these sites are presented in Appendix A and their recorded locations shown in Figure 1.4.

1.5.7.3 Of the six entries, five have been located by the site-specific geophysical survey and are discussed fully in section 1.5.8. Their locations are shown in Figure 1.4.

1.5.7.4 The remaining wreck within the Morgan marine archaeology study area is that of the *Peveril* (UKHO 7460, NMRW 240647), a British steam ship sunk on 16 September 1899 following a collision with the British steam ship *Monarch* while on passage from Liverpool to Douglas. The wreck was first recorded following survey in 1991 and confirmed by divers in 1993. In 1995 divers recovered items marked with Isle of Man Steam Packet Co indicating the wreck of the *Peveril*. The wreck is reported as largely collapsed with the engine and boilers standing 3 m proud of the seabed. The wreck lies outside the extents of the geophysical data and 385 m outside of the Morgan Array Area, but within the marine archaeology study area. Therefore, it is considered that the wreck may survive at this location but will not be considered further in this assessment. The locations of these wrecks are shown in Figure 1.4.

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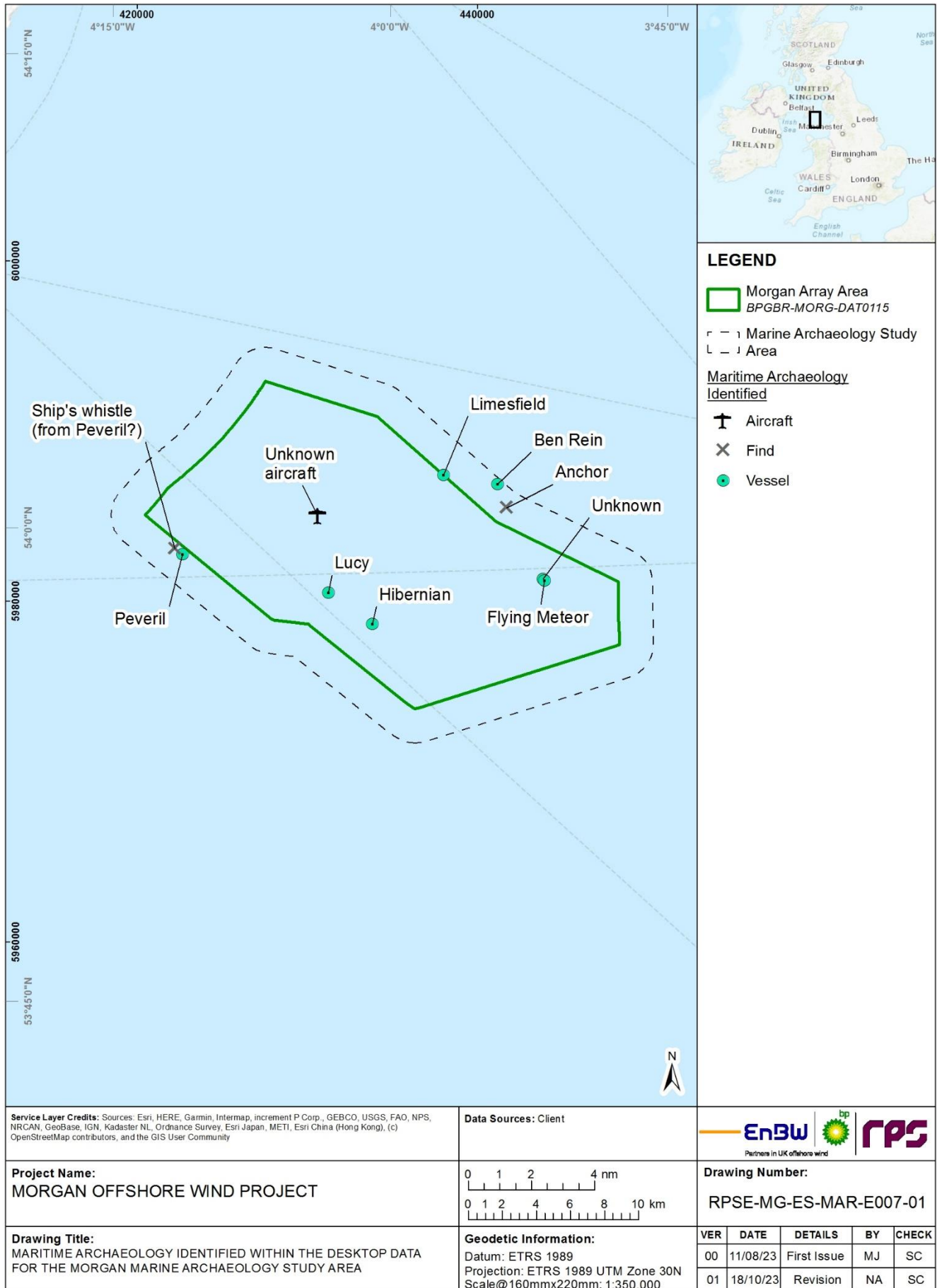


Figure 1.4: Maritime archaeology identified within the desktop data.

1.5.8 Geophysical seabed features assessment results

1.5.8.1 Geophysical data was collected across the Morgan marine archaeology study area. A total of 51 anomalies of potential archaeological interest were identified within the Morgan marine archaeology study area. Of these, five are considered to be high potential anomalies, five are of medium potential and 41 have been classed as low potential anomalies. The distribution of these can be seen in Figure 1.5. Two anomalies, medium potential anomaly Morgan_0005 and high potential anomaly Morgan_0096 lie outside the Morgan Array Area but within the marine archaeology study area. One anomaly of low potential was identified during the assessment but now lies outside the Morgan marine archaeology study area and, as such, is not counted amongst the 41 within this report. Full details of the anomalies of archaeological interest identified during the geophysical survey are presented in Appendix B.

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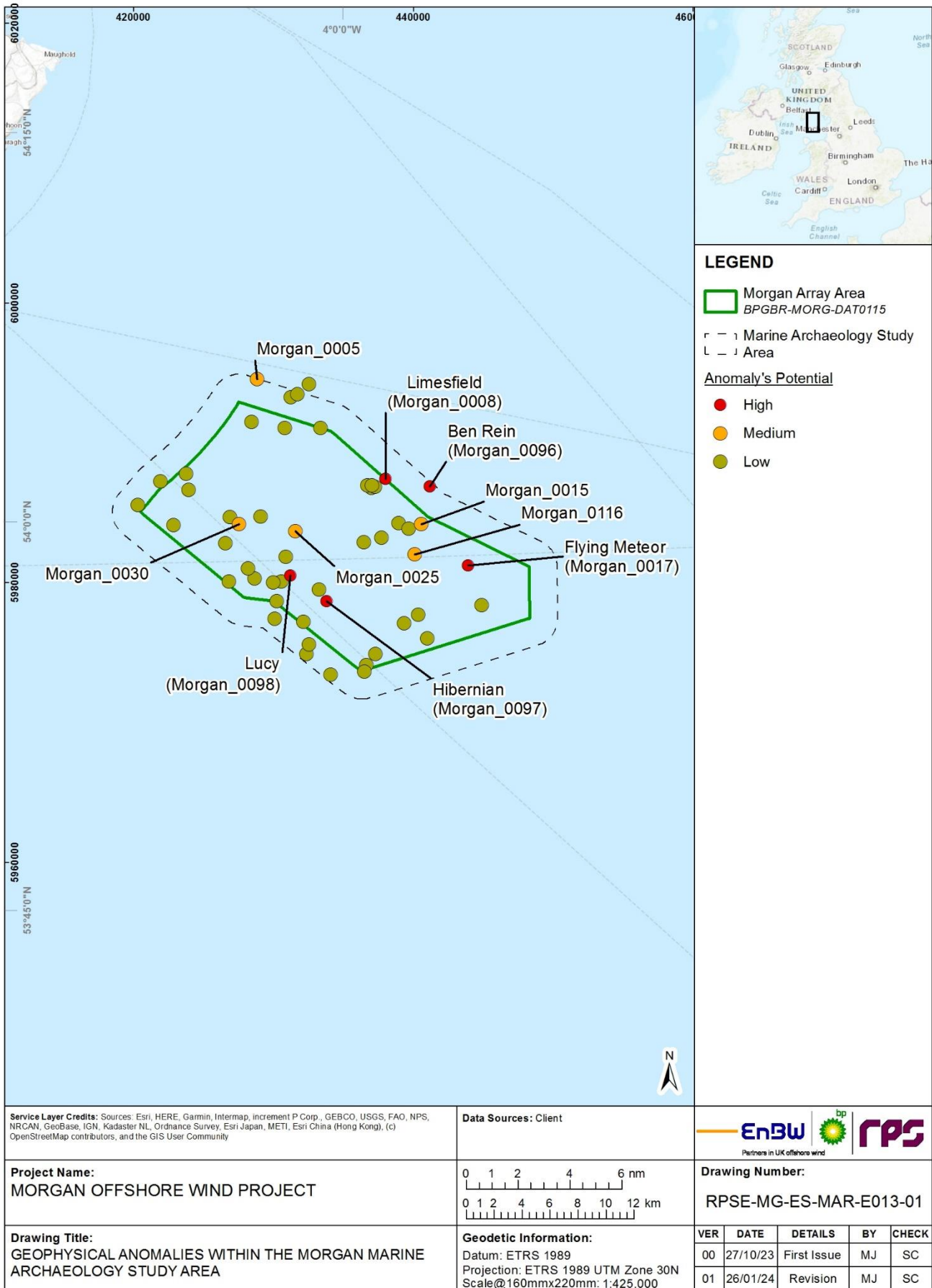


Figure 1.5: All anomalies of archaeological potential identified within the Morgan marine archaeology study area.

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Low potential anomalies

1.5.8.2 The 41 low potential anomalies are likely to predominantly represent geological features, modern debris such as chain, cable or rope and linear feature. None of these are considered to represent material of archaeological potential and are therefore not considered further within this report. Low potential anomalies will be considered within the final project design and within the Outline Offshore WSI and PAD (Document Reference J14).

Medium potential anomalies

1.5.8.3 The five medium potential anomalies are presented below in Table 1.11 and the distribution is shown in Figure 1.6.

1.5.8.4 Anomalies that could represent either geological or archaeological features have been classed as medium potential anomalies and these range from potential debris to potential wreck.

Table 1.11: Medium potential anomalies.

ID	Category	Description
Morgan_0005	Seabed disturbance	Morgan_0005 (Figure 1.7) lies approximately 50 m from the north extent of the Morgan marine archaeology study area. The anomaly has been interpreted as an area of seabed disturbance measuring 33.7 m x 16.2 m with a measurable height of 0.2 m. Whilst likely a geological feature, a number of small features within the constraints may indicate anthropogenic material. This anomaly lies outside the Morgan Generation Assets but within the marine archaeology study area.
Morgan_0015	Unidentified debris	Morgan_0015 (Figure 1.7) lies to the east of the Morgan Generation Assets approximately 1.5 km from the east boundary. The anomaly measures 12.6 m x 7.3 m with a measurable height of 0.4 m and is made up of at least three smaller features. The anomaly is largely incoherent, but potentially represents material of anthropogenic origin.
Morgan_0116	Potential debris	Morgan_0116 (Figure 1.7) lies to the east of the Morgan Generation Assets approximately 3.4 km from the northeast boundary. The anomaly measures 16.4 m, with a measurable height of 2.3 m, at the widest point it measures 6.4 m and is a prominent irregular mound. The form of the anomaly is unusual within the surrounding geology and potentially represents material of anthropogenic origin.
Morgan_0025	Potential wreck	Morgan_0025 (Figure 1.7) lies towards the centre of the Morgan Generation Assets approximately 11.2 km east of the west most corner. The anomaly is characterised by a number of incoherent features covering an area 23.2 m x 8.7 m, with a measurable height of 1.2 m. The form of the anomaly is not consistent with other geological features in the vicinity and may represent anthropogenic debris.
Morgan_0030	Potential debris	Morgan_0030 (Figure 1.7) lies in the west of the Morgan Generation Assets, approximately 7.1 km east of the west most corner. The anomaly is in an area of poor data and is only visible in the MBES data as a small depression. However, the SSS shows the anomaly as a number of linear striations in a depression measuring 13.9 m x 3.2 m, with a measurable height of 0.4 m. Although potentially geological in origin, the linear form of the anomaly combined with the poor data means a precautionary medium potential rating is appropriate.

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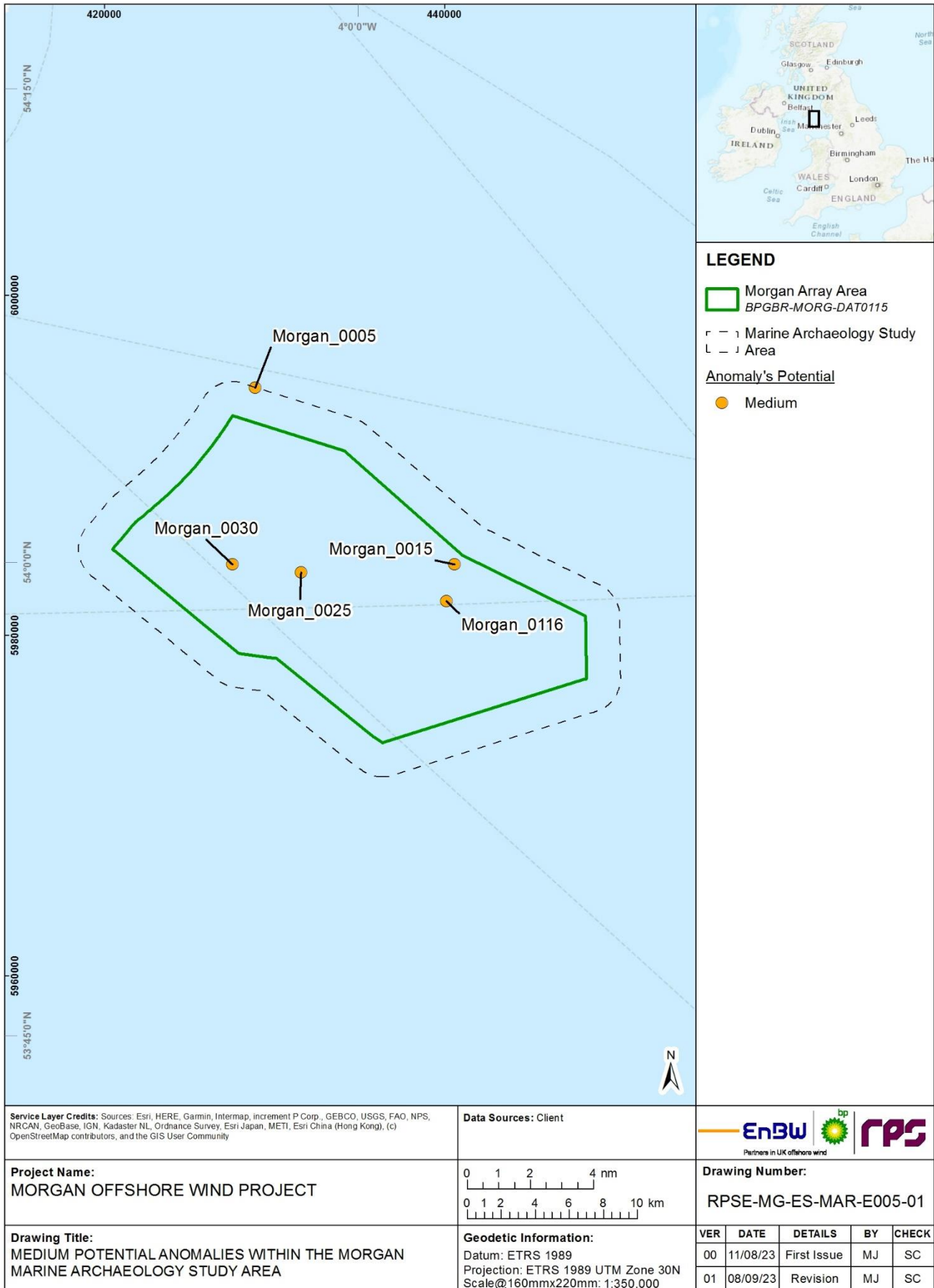


Figure 1.6: Distribution of medium potential anomalies within the Morgan marine archaeology study area.

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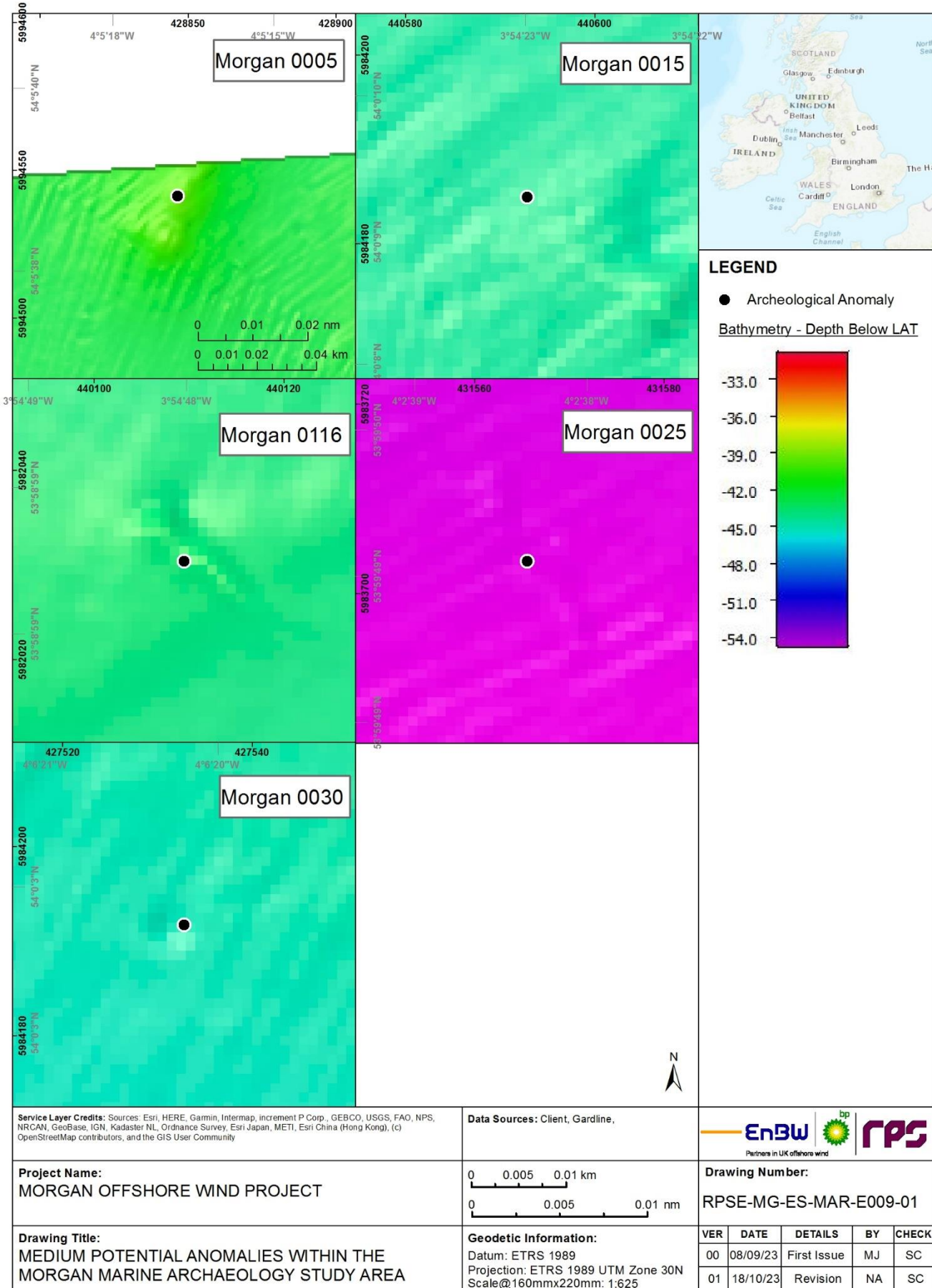


Figure 1.7: Medium potential anomalies within the Morgan marine archaeology study area.

High potential anomalies

- 1.5.8.5 Five high potential anomalies were identified within the Morgan marine archaeology study area, all of which correspond to live UKHO records for named wrecks. The distribution of these is presented in Figure 1.8.
- 1.5.8.6 Morgan_0008 (Figure 1.9) lies within the Morgan marine archaeology study area, with its central point approximately 11 m east of the eastern boundary of the Morgan Array. The anomaly is visible in both the SSS and MBES data and is recorded by the UKHO and NRHE as the *Limesfield* (UKHO 5463, NRHE 909403). A British steamship sunk by submarine UB57 on 7 February 1918 whilst on passage from Belfast to Preston with a cargo of cotton waste. There were no reported casualties. The wreck was originally recorded as a fastener by the Dutch Hydrographic Office in 1971 and confirmed as a wreck in 1991. Subsequent investigations by divers, including the recovery of the bell in 1995, confirmed the wreck as that of the *Limesfield*.
- 1.5.8.7 The anomaly is visible in the data as a prominent feature measuring 48.8 m x 9.0 m with a measurable height of 4.8 m. The form of the feature is characteristic of a wrecked vessel. The wreck appears to be lying upright and is largely intact with the bow facing towards the northeast. Slight scour is visible around the wreck to the northeast, with accumulation along the west side. The coherent form of the wreck suggests either steel construction or a wreck of wooden construction of more recent origin.
- 1.5.8.8 Morgan_0017 (Figure 1.9) lies in the east of the Morgan Generation Assets, approximately 4.3 km west of the Morgan Array Area boundary. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO and NRHE as the *Flying Meteor* (UKHO 8250, NRHE 909493). A British paddle steamer tug built in 1864 and sank on 13 March 1874 whilst towing the barque *Ravenbourne* from Liverpool to Troon. The crew of the *Flying Meteor* boarded the *Ravenbourne* which returned to Liverpool. The wreck was first recorded in 1991 as a fastener, and then amended to an isolated rock. In the same year divers noted the remains of a wreck. In 2000 divers identified the wreck as a paddle steamer tug, with the recovery of a wheel boss identifying it as the *Flying Meteor*. In 2001 divers reported the wreck to be well covered in shingle with the highest point being the paddle wheel boxes.
- 1.5.8.9 The anomaly is visible in the MBES data as an incoherent mound in amongst a number of sand waves, within the SSS data the anomaly is still largely incoherent, but more wreck like in form. The anomaly consists of a number of parallel linear features in a broad wreck like shape over an area 28.9 m x 9.9 m with a measurable height of 1.7 m. The wreck appears in poor condition, with very little evidence of scour or accumulation.
- 1.5.8.10 Morgan_0096 (Figure 1.9) is located approximately 290 m southwest of the extent of the Morgan marine archaeology study area. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO and NRHE as the *Ben Rein* (UKHO 5462, NRHE 909472). A British carrier built in 1905 and sunk by submarine UB57 on 7 February 1918. The crew were allowed to leave the vessel on a small boat and no casualties were reported. The vessel was on passage to Belfast from Liverpool with a general cargo. The wreck was originally recorded as a fastener by the Dutch Hydrographic Office in 1971 and confirmed as a wreck in 1996. The wreck was dived on multiple occasions in 1997 where soap was observed packed into the hull, and a bell recovered bearing the inscription Starling. A further dive in 1998 reported crates containing waxed paper.

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- 1.5.8.11 The anomaly is visible in the data as a coherent wreck in amongst sandwaves and measuring 34.5 m x 7.6 m and with a measurable height of 2.8 m. The wreck appears largely intact and likely lying upright. Scour, or a disturbance in the sand waves, is visible to the northeast which is likely the stern. This wreck lies outside the Morgan Generation Assets boundary but within the marine archaeology study area.
- 1.5.8.12 Morgan_0097 (Figure 1.9) lies towards the south of the Morgan Array Area, approximately 5.6 km north-northwest of the most south point. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO (7458), NRHE (909402) and NMRW (506875). As the wreck of the *Hibernian*, a British steam ship built in 1875 and lost on 12 August 1894 following a collision with the British paddle steamer *Prince of Wales* whilst on passage from Garston to Glasgow. Of the ten crew, two were lost. The wreck was first identified in 1991 with divers recovering the ships wheel bearing the name of the builders of the *Hibernian* in 1993. The most recent diver accounts from 1996 report the wreck as very broken up and partially buried with the boilers at the highest point.
- 1.5.8.13 The anomaly is visible in the MBES data as an incoherent mound with low lying debris to the southeast, within the SSS data the anomaly is still largely incoherent, but more wreck like in form with significant height amidships. The anomaly consists of a number of parallel linear features in a broad wreck like shape over an area 48.9 m x 19.7 m with a measurable height of 3.7 m. The wreck appears in poor condition, with evidence of scour extending to the northeast.
- 1.5.8.14 Morgan_0098 (Figure 1.9) lies towards the south of the Morgan Array Area, approximately 2.3 km northeast of the southwest boundary. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO (7559) and NMRW (506874). Identified as the wreck of the *Lucy*, a small British steam ship built in 1899 and sunk on 21 July 1910 whilst on passage from Weston Point to Douglas with a cargo of moulding. All four crew were recovered. The wreck was first identified in 1991, the bell was recovered in 2006 confirming the identity as the *Lucy*. The divers reported the wreck as very low lying with the engine and boiler protruding above the seabed by 4 m.
- 1.5.8.15 The anomaly is visible in the MBES data as a prominent and irregular mound, increasing in prominence to the west. Within the SSS data the anomaly is characterised by incoherent features and a large mound to the west, the anomaly covers an area 24.7 m x 8.9 m with a measurable height of 5.8 m. The form of the anomaly is clearly of anthropogenic origin, and the size likely indicates the remains of a wrecked vessel. Scour is visible extending to the northeast.

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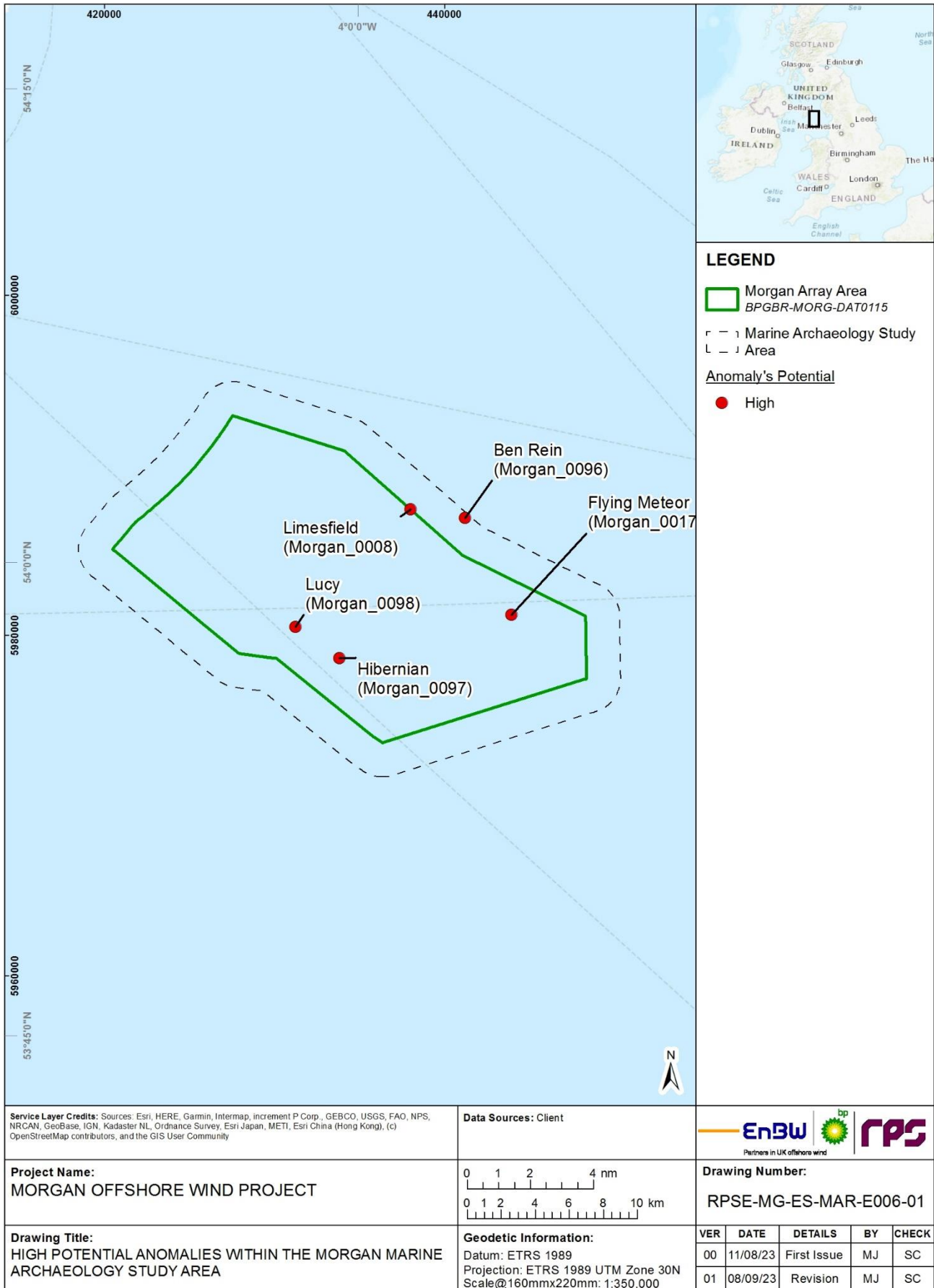


Figure 1.8: Distribution of high potential anomalies within the Morgan marine archaeology study area.

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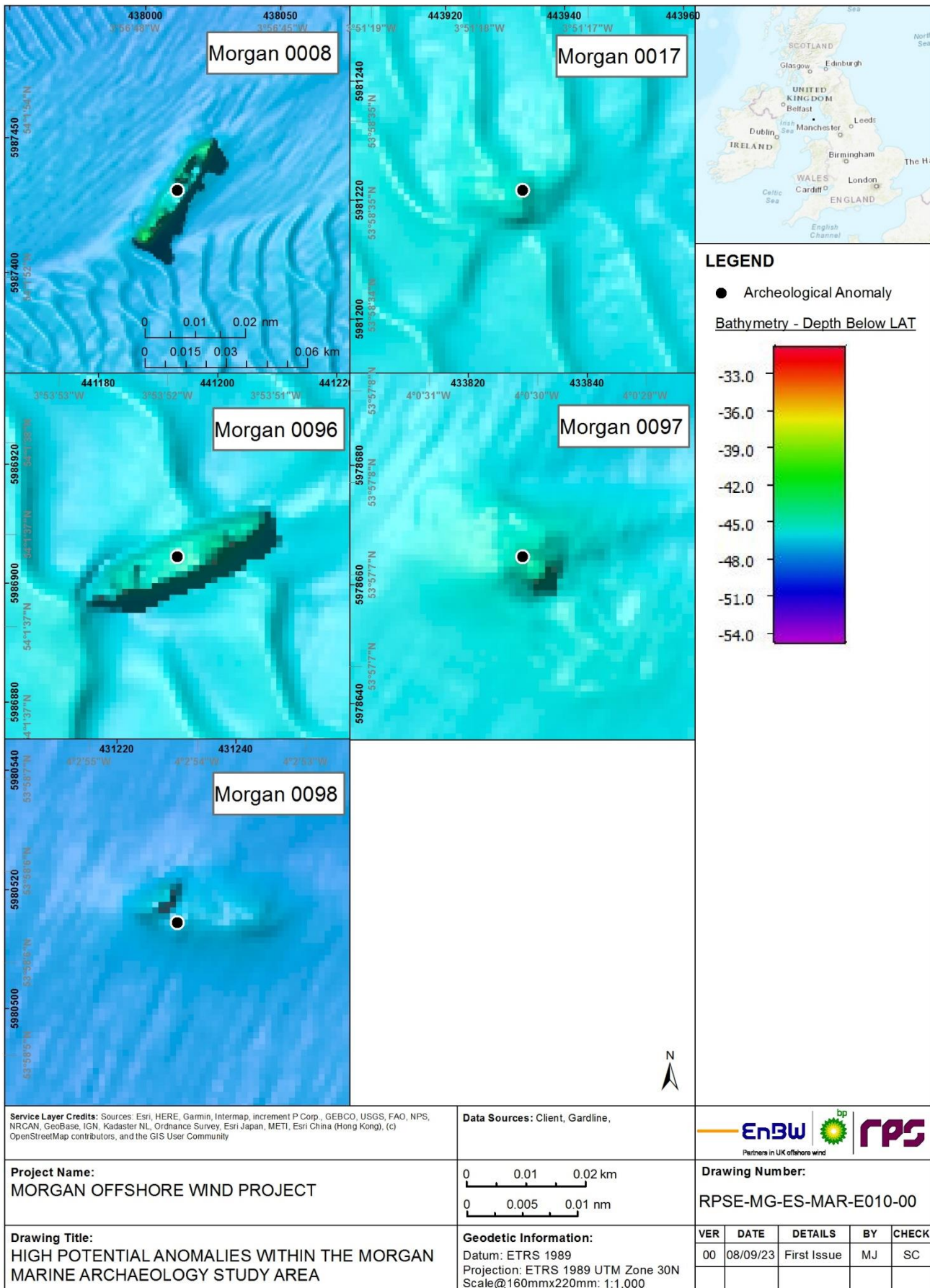


Figure 1.9: High potential anomalies within the Morgan marine archaeology study area.

1.6 Summary

1.6.1 Submerged prehistoric archaeology

- 1.6.1.1 The potential for the survival of submerged prehistoric archaeology within the Morgan marine archaeology study area is predominantly confined to the Upper Palaeolithic and Mesolithic periods. Geophysical and geotechnical survey data has identified deposits that may indicate that areas within the Morgan marine archaeology study area were a terrestrial or intertidal environment during these periods. However, Stage 1 geoarchaeological assessment concluded that there was no potential for the survival of prehistoric archaeological material within the five boreholes assessed.
- 1.6.1.2 Palaeocoastline modelling and reconstructions developed by variety of other research projects (Flemming 2005; Ransley *et al.*, 2013; Sturt *et al.*, 2013; Shennan *et al.*, 2018; Brooks *et al.*, 2011) indicate that the Morgan Array Area was submerged as early as 11 ka BP, although WCPS data suggests that the Morgan Array Area was still under intertidal conditions after this point (Fitch *et al.*, 2011). Further evidence on the timing of the transgression is therefore required to determine when the Morgan marine archaeology study area was finally submerged. Therefore, Stage 2 geoarchaeological assessment is recommended to advance the understanding of the Devensian ice retreat in the East Irish Sea.

1.6.2 Maritime and aviation archaeology

- 1.6.2.1 Geophysical surveys have identified five high potential anomalies and five medium potential anomalies within the Morgan marine archaeology study area. All five high potential anomalies can be correlated with records held by either the UKHO, NMRW or NRHE. Three of the identified wrecks, the *Flying Meteor*, *Hibernian* and the *Lucy* date to the 19th century, and two, the *Limesfield* and *Ben Rein* were casualties of the German submarine UB57 during WWI. A full impact assessment of marine archaeology receptors has been undertaken and presented in Volume 2, Chapter 8: Marine archaeology and cultural heritage of the Environmental Statement.

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Appendix A: Gazetteer of maritime archaeology identified within the desktop data

Name	UKHO	NRHE	NMRW	X	Y	Description
Ben Rein (Morgan_0096)	5462	909472	-	441193.3	5986904	A British carrier built in 1905 and sunk by submarine UB57 on 7 February 1918. The crew were allowed to leave the vessel on a small boat and no casualties were reported.
Flying Meteor (Morgan_0017)	8250	909493	-	443932.9	5981222	A British paddle steamer tug built in 1864 and sank on 13 March 1874 whilst towing the barque Ravenbourne from Liverpool to Troon.
Hibernian (Morgan_0097)	7458	909402	506875	433829.1	5978665	a British steam ship built in 1875 and lost on 12 August 1894 following a collision with the British paddle steamer Prince of Wales whilst on passage from Garston to Glasgow.
Limesfield (Morgan_0008)	5463	909403	-	438011.8	5987431	A British steamship sunk by submarine UB57 on 7 February 1918 whilst on passage from Belfast to Preston with a cargo of cotton waste. There were no reported casualties.
Lucy (Morgan_0098)	7459	-	506874	431230.2	5980514	A small British steam ship built in 1899 and sunk on 21 July 1910 whilst on passage from Weston Point to Douglas with a cargo of moulding. All four crew were recovered.
Anchor	4560	-	-	441703.8	5985507	Find
Peveril	7460	-	240647	422681.3	5982769	The Peveril was a steamship owned by the Isle of Man Steam Packet Company. On 16 September 1899, it was returning to Douglas from Liverpool when it was in collision with the British steamship Monarch and sank.
Ship's whistle (from Peveril?)	-	-	240772	422235.5	5983095	Find
Unknown aircraft	5418	909495	-	430634.9	5985017	Possible remains of an aircraft.
Unknown	8250	909493	-	443842.7	5981316	Broken remains of a vessel, probably a trawler.

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Appendix B: Gazetteer of potential anomalies within the Marine archaeology study area

Name	Potential	X	Y	UKHO	NRHE	NMRW	Description	L (m)	W (m)	H (m)
Ben Rein (Morgan_0096)	High	441193.3	5986904	5462	909472	-	Wreck	34.53	7.61	2.77
Flying Meteor (Morgan_0017)	High	443932.9	5981222	8250	909493	-	Wreck	28.85	9.87	1.69
Hibernian (Morgan_0097)	High	433829.1	5978665	7458	909402	506875	Wreck	48.9	19.7	3.67
Limesfield (Morgan_0008)	High	438011.8	5987431	5463	909403	-	Wreck	48.75	9.04	4.76
Lucy (Morgan_0098)	High	431230.2	5980514	7459	-	506874	Wreck	24.73	8.92	5.81
Morgan_0002	Low	431726.2	5993474	-	-	-	Potential debris	6.32	1.62	0.39
Morgan_0004	Low	431264.4	5993280	-	-	-	Chain, cable or rope	16.85	15.46	0.19
Morgan_0005	Medium	428856.5	5994556	-	-	-	Seabed disturbance	33.72	16.2	0.22
Morgan_0006	Low	433383.7	5991079	-	-	-	Likely geological	59.47	14.55	0
Morgan_0010	Low	436720.8	5986970	-	-	-	Potential debris	8.79	6.04	1.17
Morgan_0012	Low	437057.8	5986980	-	-	-	Potential debris	9.85	6.34	1.21
Morgan_0013	Low	437021.4	5986788	-	-	-	Potential debris	7.63	6.3	0.86
Morgan_0014	Low	437270.6	5986868	-	-	-	Linear feature	14.63	0.4	0
Morgan_0015	Medium	440592.8	5984185	-	-	-	Unidentified debris	12.55	7.34	0.39

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Name	Potential	X	Y	UKHO	NRHE	NMRW	Description	L (m)	W (m)	H (m)
Morgan_0016	Low	430815.2	5991084	-	-	-	Linear feature	13	0.39	0.22
Morgan_0018	Low	439679.7	5983879	-	-	-	Debris	3.24	2.75	0.51
Morgan_0019	Low	438957.1	5984251	-	-	-	Likely geological	3.14	0.53	1.16
Morgan_0020	Low	428434.9	5991489	-	-	-	Likely geological	4.42	1.57	0.23
Morgan_0021	Low	437751.6	5983211	-	-	-	Potential debris	3.74	0.75	0.29
Morgan_0022	Low	444923.1	5978390	-	-	-	Chain, cable or rope	23.39	0.88	0
Morgan_0023	Low	436488.2	5982903	-	-	-	Potential debris	7.24	2.22	0
Morgan_0024	Low	440377.8	5977691	-	-	-	Likely geological	35.99	0.56	0.26
Morgan_0025	Medium	431565.5	5983703	-	-	-	Potential debris	23.2	8.71	1.17
Morgan_0026	Low	429097.6	5984725	-	-	-	Debris	4.48	0.87	0.38
Morgan_0027	Low	441016.5	5976030	-	-	-	Potential debris	3.53	1.59	0.45
Morgan_0028	Low	423776.6	5987800	-	-	-	Debris	5.24	1.57	1.84
Morgan_0029	Low	439342.4	5977091	-	-	-	Linear feature	7.41	0.56	0.17
Morgan_0030	Medium	427532.8	5984192	-	-	-	Unidentified debris	13.86	3.22	0.41
Morgan_0031	Low	426909.3	5984696	-	-	-	Potential debris	31.27	4.55	0.92
Morgan_0032	Low	430908	5981869	-	-	-	Chain, cable or rope	40.12	0.47	0.2

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Name	Potential	X	Y	UKHO	NRHE	NMRW	Description	L (m)	W (m)	H (m)
Morgan_0033	Low	423940.6	5986633	-	-	-	Potential debris	2.64	1.22	0.81
Morgan_0034	Low	433270.5	5979528	-	-	-	Fishing gear	190.82	0.39	0
Morgan_0035	Low	437304.6	5974904	-	-	-	Likely geological	12.63	2.75	0.57
Morgan_0036	Low	428192.5	5981034	-	-	-	Potential debris	4.67	0.74	0.44
Morgan_0037	Low	428660.5	5980302	-	-	-	Potential debris	4.5	0.56	0.51
Morgan_0038	Low	422857.2	5984137	-	-	-	Chain, cable or rope	11.42	0.06	0.16
Morgan_0039	Low	430254.2	5978691	-	-	-	Potential debris	3.7	3	0
Morgan_0040	Low	436645.5	5974091	-	-	-	Chain, cable or rope	107.64	0.23	0.2
Morgan_0041	Low	432153.4	5977221	-	-	-	Debris	3.18	2.48	1.38
Morgan_0042	Low	420313.3	5985573	-	-	-	Unidentified debris	4.64	0.39	0.67
Morgan_0043	Low	436516.5	5973643	-	-	-	Debris	5.03	1.57	0.4
Morgan_0045	Low	426841.8	5980082	-	-	-	Seabed disturbance	11.43	6.77	0
Morgan_0046	Low	430106.7	5977432	-	-	-	Potential debris	5.71	3.16	0.57
Morgan_0047	Low	432566.7	5975583	-	-	-	Linear feature	18.08	3.87	1.24
Morgan_0048	Low	432388.9	5974904	-	-	-	Chain, cable or rope	30.58	0.15	0.16
Morgan_0049	Low	434092.2	5973434	-	-	-	Potential debris	2.01	0	0.51

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Name	Potential	X	Y	UKHO	NRHE	NMRW	Description	L (m)	W (m)	H (m)
Morgan_0095	Low	430011.1	5980005	-	-	-	Potential debris	2.13	0.26	0.3
Morgan_0099	Low	421916.5	5987244	-	-	-	Chain, cable or rope	23.27	0.34	0.08
Morgan_0104	Low	430580	5980092	-	-	-	Likely geological	1.19	0.6	0.43
Morgan_0107	Low	426564.9	5982806	-	-	-	Unidentified debris	2.2	0.12	0.2
Morgan_0116	Medium	440109.5	5982030	-	-	-	Unidentified debris	16.4	6.35	2.3